American Machinist

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Bearings For the Soviets

Part I—Planning the Kaganovitch Project

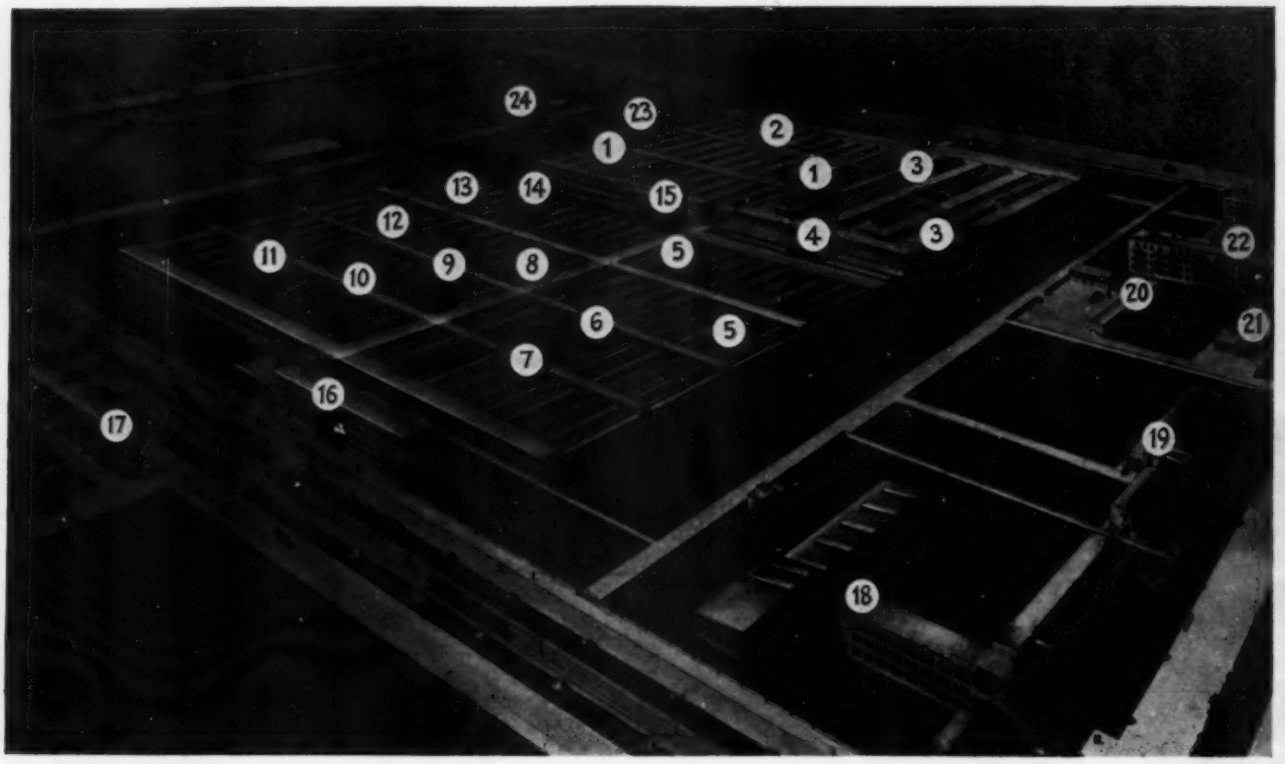
Many readers of American Machinist have done business with the Soviets, many others would like to. In this article and the ones to follow it, the author tells of his experience in the planning, equipping and operating of the plant that is supposed to supply the needs of the U.S.S.R. for anti-friction bearings. As he was employed by the Soviet government for the better part of two years he had an excellent opportunity to study the psychology of the Russian and to discover how to reconcile American and Russian differences in point of view. These articles are timely because of the impending visit of a commission of Russian engineers to investigate our methods of building machine tools and to report on the advisability of the establishment of a machine tool industry in the Soviet Republic.

FRANK SCHUBERT

NAMED in honor of the secretary of the Moscow regional Communist Party—the man whose comment on the so-called counter-revolutionary plot of last Fall was, "Why cry over cracked eggs, when we are trying to make an omelette?"—the first Russian state plant for the manufacture of anti-friction bearings was originally intended to provide such bearings for Soviet Russia's automotive industry. That is, for the Amo 3-ton truck, the Yaroslav 5-ton truck and bus, the Ford models A and AA, the Fordson tractor (now out of production), two sizes of International wheel type tractors, and a copy of the Caterpillar 60 draw-bar hp. tractor. Also for the Velo or motorcycle plant and at least one size of bearing for a combine harvester. It was intended that this plant, scheduled to be running at full capacity by the end of 1931, would offset purchases of imported ball and roller bearings to the extent of at least $12,000,000 per year on the basis of 1929-30 prices. The bulk of that business probably is now going to Italy and to Sweden, although America had a share of it in 1930.

The inception of the plant being of Moscow origin, Orgametal, in Moscow, made the first try at setting up the project in 1928. There the original product drawings, the tolerance tables, an arrangement of technological processes, and a rough draft of the equipment required were made. Probably this original project appeared to have some rough spots, so it was sent to the Orgametal branch bureau in Berlin, for "polishing up." There Germany's foremost technical specifications engineer was called in as consultant.

But apparently there still was either some doubt about the accuracy of the project, or too much disagreement over its adoption, in toto, for in 1929 a small commission was sent from Moscow to the United States with the thought that some American bearing manufacturer would accept a technical assistance contract to plan the project, instruct fairly large groups of set-up men, and supervise its accomplishment. Such a plan did not meet with immediate acceptance here, so the bearing commission retained an American engineer, who had had bearing manufacturing experience, to head a staff to lay out an American project. Late in the autumn of 1929, this Ameri-



can staff was augmented by a group of Russian engineers headed by a chief engineer who had been city engineer of Moscow—extremely conscientious and untiring in his efforts.

Even with this combined Russian-American staff working on its project, the effort to place a technical assistance contract with an American bearing manufacturing company was not abandoned. The plum of a large share of the annual bearing business was offered as an incentive, but apparently this was not great enough to offset the fear of the possible final result of "setting-up" one more colossal competitor in the bearing production field—"colossal" because it was expected that Moscow would shelter the largest anti-friction bearing plant in the world, in one operating unit.

Reporting for work the first week in March, 1930, the writer was given a copy of the annual bearing production program and a proposal from an American manufacturer of machines for one of the grinding operations on ball bearing rings, and was asked to check the proposal against the best American practice.

With a year's unalterable program in hand, the first thought was, "What a paradise that would be to the normal production man in the bearing field! And no competition!" Well, "the unalterable" later was proved to be almost as much of a dream in Russia as it is in America, with probably the same applying to "no competition" as time goes on. By the end of the fifth day's (and evening's) work, the particular grinding problem in hand had been broken down and built up to a final detailed "purchasable" report, with proposed motion times, idle time, and machine loads allotted. During that period it was learned that a rather large staff was already applying itself to similar problems on other operations.

No Half-way Measures

Furthermore, it became apparent that the Russians were to be content with no half-way plan; that it was not sufficient to proposed certain operations, designs, processes, or equipment as "best, because we do it that way"; for after such a proposal the immediate question was, "Why?" Building up the answers to these "Why's" was often disconcerting to some members of the American staff, for analysis and summary often resulted in a changed proposal. That was the writer's first experience with Russian thoroughness, and it proved well to remember it. When one began to realize the huge responsibility the Russian staff was shouldering, the need for minute detail work and for thoroughness to the Nth degree was quite apparent. But lack of recognition of these needs was the cause of many wasted hours of talking rather than of working. Looking backward on this lack of understanding of the Russian problem, it is difficult to believe that they have accomplished as much as they have of the Five Year Plan in Four Years.

By the second Sunday the newest member of the staff had been introduced to the chief engineer, the first impression being that the chief was not overly pleased at being presented with an assistant chief in charge of the ball bearing division, selected during his absence. Apparently, however, he welcomed some help, for the assistant was asked to interview some applicants for positions on the staff, and was offered every obstacle to his stopping work at 4:30 on that second Sunday afternoon. All through the work, a day could consist of 24 hours, and on occasion did! Such was my ushering in to the routine work of the Russian bearing commission, the most trying, if not the hardest work, I have ever done.

Thus, two years before production of finished bearings actually was to be accomplished, three bureaus or commissions, in as many countries, had built up and rehashed the project. But these were not deemed sufficient, for finally a total of five bureaus in four countries, with three working simultaneously, were required to present a final plan which brought about a sufficiently close agreement among the various objectors to make it apparent to the Soviet Industrial Control that success could be reasonably assured.

With the "unalterable" program consisting of approximately 120 sizes of anti-friction bearings, i.e., ball bearings,

Artist's drawing of the state bearing plant in Moscow. Capital investment — 116,000,000 rubles, including 35,000,000 rubles for imported equipment. Ground space covered—1 sq.km. Number of machines — 5,000. Number of employees—15,000. Yearly output — 24,000,000 bearings. Estimated value—120,000,000 rubles

Key to Buildings: 1—Tools; 2—Repairs and Maintenance; 3—Forge Shop; 4—Annealing; 5—Automatic Lathes; 6—Heat Treating; 7—Grinding; 8—Ball Division; 9—Tapered Roll Division; 10—Cylindrical Roll Division; 11—Retainers; 12—Helical Roll Division; 13—Assembly; 14—Finished Bearing Stockroom; 15—Central Auxiliary (compressors, etc.); 16—General Offices; 17—Workers' Cooperative Apartments; 18—Factory School for 2,000 Students; 19—Central Laboratories; 20—Garage; 21—Fire Station; 22—Homes for Staff Employes; 23—Auxiliary Material Stores, 24—Oil Stores; (Factory Kitchen and Dining Hall, also Hospital and Nursery, not shown)

tapered roller bearings, helical roller bearings, cylindrical roller bearings, and simple ball retainer assemblies, to a total of 24 millions of bearings per year, some idea of the magnitude of the project is apparent. Of course, one would think, since these bearings were then being purchased abroad, that there would be no questions about design of the various bearings, materials, or in fact about any technical specification. But aside from the fact that so many suppliers in at least three different countries were furnishing these bearings, and the fact that international standards and S.A.E. tolerances do not coincide, some of these suppliers had changed the internal design of the bearings being furnished early in 1930, compared with those being delivered in 1928, when Orgametal set up the first rough project. In fact by April of 1932, the detailed design of one series of bearings was still being revamped and production held up to endeavor to make the sub assemblies interchangeable with the latest type being shipped in from Sweden—a new supplier of that series.

Quite early it was apparent that one or two errors in the program were at least possible, for it did not contain a certain bearing for the Ford Model AA, apparently because the original planners had assumed that the A and AA transmission details were identical as to bearings. One additional size of cylindrical roller bearing had been added (to the quantity of something more than a million) by cable from Moscow, three controlling dimensions being given, but not named, in the cable. When the American project finally reached Moscow, it was discovered that the bearing wanted was really only a roller retainer assembly for a harvester combine and that the outside diameter had been confused with the width! Such an error could make a difference of several hundred thousand dollars in equipment purchases, to say nothing of a highly over-estimated steel schedule. Fortunately, however, these errors as well as many others, were caught before money had been spent otherwise than on projecting. Some of the more daring Russian engineers waged a constant battle with the director of the commission in New York, insisting that it was far more important in the final success of the whole plan to have an early completion of the manufacturing building than it was to delay construction until a project could be presented which would be forever "just right"!

In laying out the technological processes, the commission, through Amtorg Trading Corporation, originally had sent copies of the program with dimensions and schematic drawings of the bearings to many American equipment manufacturers. With these had been sent a request for quotations (on equipment which the manufacturers made as applicable to the production of the bearings) and for suggested stock-allowances, tolerances, etc., as based on the best American practice. This was assuming a rather broadly distributed knowledge of bearing manufacture. Naturally, some highly conflicting process plans were proposed. Those few manufacturers who could supply rather specialized equipment for a specific operation, of course, presented material which could be used almost at once as a planning basis. Others predicated their proposals upon certain assumed materials and preceding operations, while still others began their proposals with a résumé of the various ways in which the jobs could be performed, and requested definite instructions as to which process should be used as a basis for quotation. The net result was a mass of questions.

American Specialists in Charge

As a consequence, the staff division lines were more rigidly drawn, with an American specialist in charge of the tapered roller bearing division, another in charge of the ball bearing division, and a third in charge of the helical and cylindrical roller bearing division. These three specialists functioned as assistants to the chief engineer. The next assignments were of the Russian engineers to the various departmental divisions: Stores, Forge Shop, Turning, Heat Treating, Grinding, Ball Making, Roller Making, Press Operations, Assembling and Packing, Tools and Dies, and Repairs and Maintenance. Each of these Russian engineers (in two cases, Russian-Americans) had had experience in the particular line to which he was assigned. An American assistant was delegated to each of them. These departmental divisions were to be given the technological processes by the three acting assistants to the chief engineer. Actually, these processes were the result of a combination of individual and collective efforts on the part of the assistants, together with many long conferences of various and varying staff groups.

Detroit Advises on Building

Then there were the problems of the building, i.e., general lay-out, detail design, method of waste material disposal, material handling, etc. The chief engineer spent much of his time in Detroit on these problems, in conference with engineers of the Kahn and the Ford organizations. Also there were long conferences of the general staff on these subjects. Half of one Sunday was given over to a conference at which the sole subject was the placing of the buildings (as then projected) on the building site. This site, being on a plot one kilometer square at the edge of the low plateau on the southernmost edge of Moscow proper, had a considerable slope, requiring filling or excavating. One of the proposals of that conference was to leave the slope "as is," and to build the plant with a slightly pitched floor. Finally, three general schemes of building arrangement were prepared and presented by their various sponsors to a conference wherein were present Kahn engineers, the general engineering staff of Amtorg and the bearing commission. A moot question propounded just before the conference was whether it would be advisable to build three separate bearing plants, one for each of the three general types of bearings to be made!

Prior to this conference, of course, the revamped technological process charts had been released to the departments for application to the program; and the breakdown of the work with subsequent machine loading and arrangement had been completed. There were some dissenters to the building plan as finally adopted, in New York; the writer was assured that his approval by signature need not be given if he were not in accord with the plan. However, there were, at the most, only two or three omissions of signatures.

Shortly after this the New York staff heard, with some consternation, the rumor that the ball bearing and the ta-

pered roller bearing work were to be transferred to Italy; and only the helical and the cylindrical roller bearing portions of the work were to be completed in America. In the meantime, four or five additional Russian engineers had arrived from Moscow, either to assist in or to check the work here. This also was a bit disconcerting, for some of them were good "objectors" to anything which had been decided upon definitely. Following this rumor, the director left hurriedly for Europe, as did the chief engineer. And a few weeks later the bulk of the Russian engineering staff sailed under apparently "sealed orders," for their destination was not announced. It was known, however, that to the reduced staff remained the task of thoroughly completing the helical roller and the cylindrical roller bearing set-up.

The Russian engineer remaining as the then chief of staff had been an engineer in the Soviet car-building and locomotive shops. He was a leader, an analyst, and a hard and conscientious worker. As his assistant, the writer was at once directed to prepare a detailed chart of all the necessary work to be completed, and its assignment to individual members of the staff, together with a set schedule for its completion. Thus a definite plan for consecutive release of the American personnel could be formulated and an accurate expense budget drawn up. At the time, that appeared to be the first indication that the pinch of world depression was affecting even the elaborate plans of the Soviet. Later, it was apparent that in all probability this was simply a part of the newer budgeting plan for all project and plant expenditures, and that these would be more closely controlled.

Moscow Via Turin

At last, early in August, 1930, the younger staff members were recalled from the Ford plant and the final set-up approved. Three of the staff returned to some of the smaller bearing plants, for observations, and four Americans and the chief of staff prepared to sail for Russia at the middle of August. But at noon of sailing day the chief of staff was directed by cable to remain in New York, and two days out of New York, the writer was radioed to report to a portion of the commission at the Riv bearing plant in Turin, Italy. The subsequent four weeks of waiting for definite instructions in Turin, Paris and Berlin, coupled with the Italian coolness toward a "perpetrator" of the "Amerikanski" project, will remain more or less of a nightmare to the writer. Eventually, an associate induced the director of Orgametal in Berlin to telephone to Moscow for instructions, and four days later, the first sight of Moscow with its ever apparently-holiday crowds was viewed—with pocket assets of 13 kopeks. Only then was it learned that the four instructionless weeks were a result of the transfer of the bearing commission (then called Sharikopodshipnikstroy) from the Machine Building Trust to the newly formed All Automobile and Tractor Trust, briefly known as VATO. The transfer of operating functions was complete, but the budget arrangements were not to the liking of the new "holding" trust.

Then also was it first learned that the Riv Company or Officine' Villar Perosa of Turin, Italy, had signed a technical assistance contract with the Machine Building Trust to supervise the job complete from project to finished plant, in operation. Through its connection with Fiat (partly American owned) Riv apparently arranged to send observers into one American plant to acquire the experience they had not had on the manufacture of one type of bearing. This same American plant had not accepted such an arrangement with the Soviet direct.

Nine Weeks of Argument

There followed eight or nine weeks of more arguments: American plans versus Italian plans, new directorate, new chief engineer, new objections, and so, delay. Italian engineers, Swedish engineers, Bulgarian engineer, American engineers, Russian engineers—eighteen or twenty persons in one room, including French, German and Italian interpreters. This same room, a year later, had become an exquisite modern hotel sitting room with a bath and a sleeping alcove. By the end of that period, the Italian project was not complete and it was apparent that the plant was getting "nowhere fast," beyond a final agreement on building size and design. Then word was rumored about that a commission would be returned to Italy for final set-up there.

On the 29th day of November, the writer departed (on verbal instructions) for Turin, a second time—and there was to be a then unforeseen third time. But Moscow, with its trusts and its control bureaus, was still to be the "seat of acceptance." Not that it was jealous of its prerogatives, but perhaps because there the warring factions or objectors could meet face to face, if not see eye to eye, or because there were the headquarters of a hundred and sixty millions of people who were clamoring for results from the belt-tightening sacrifices they were making to carry on the Industrial Plan—and grim necessity was the mother of, in this case, agreement.

(*First of a series. The second will appear in the next issue.*)

Second Operations on Automatic Screw Machines

C. W. HINMAN

Products of the automatic screw machine often require a second operation on the inside cut-off end. Common examples are: magnetic iron cores, plate separators, mechanism shafts, pinion rods, posts, studs, tubes, and rollers. The second operation may involve: cutting to accurate lengths, threading, drilling and tapping, straddle milling, knurling, box tooling, pointing, centering, drilling, reaming or reforming.

Second operations of these types are usually performed by using a magazine chute which is bolted to the front toolpost. The magazine is attached at right angles to the center line of the spindle at an angle of 30 to 45 deg. to the horizontal. It may be made from light cold-rolled steel strips about 18 to 24 in. long, riveted togther. A small horizontal hopper is attached at the upper or feeding end of the magazine for holding extra work which is to be fed into the magazine opening. The opening is usually T-slot in shape, and about $\frac{1}{32}$-in. wider than the length of the work.

The rise on the front cam advances the magazine until the first piece of work, at the bottom of the magazine, is coincident with the hole in the spindle chuck. A sufficient dwell on the cam lobe holds the magazine in this position until the work is fed into the chuck. This is accomplished by the timely advance of the turret which carries a feeding stud, smaller in diameter than the work, lined up with it and backed by a coiled spring. One piece of work is pushed out, enters the chuck and contacts a positive stop, fixed at the proper depth within the chuck. The chuck closes and holds the work in its proper working position.

The turret recedes first and then the magazine. The work is now ready for machining by tools held in the back slide post and by those in the remaining holes in the turret. A spring plunger behind the chuck and passing through the positive stop ejects the work upon completion when the chuck opens. The ejected work contacts the face of a fiber pad held in the turret and then falls into the pan without injury. The chuck is now ready for another piece of work, and the operations described in detail are repeated.

Many similar operations can be done: the limit is only the length of the piece the machine will take and a straight diameter on the work sufficiently long to make a magazine set-up practical. A magazine job is not usually run in a machine smaller than the Brown & Sharpe No. 0.

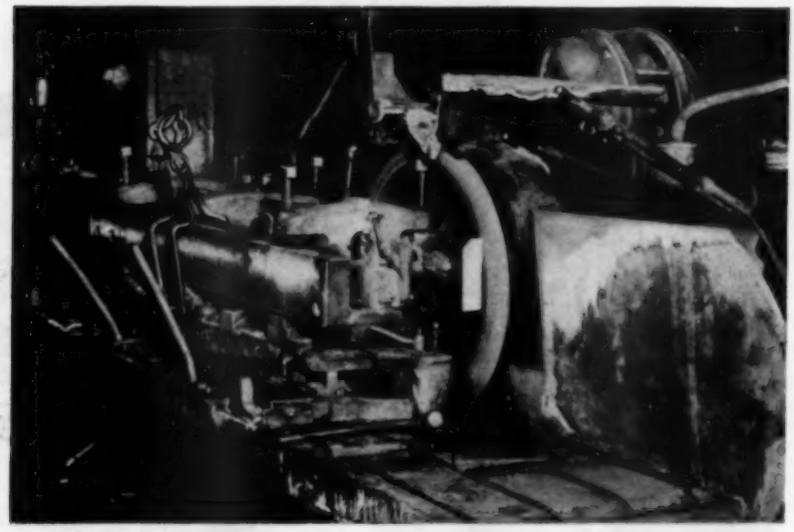


Fig. 1—A double-sided fixture makes it possible to load one guide bar while another is being ground

Grinding Operations in Locomotive Repair

FRED B. JACOBS

A Mid-West railroad shop has installed modern grinding methods and equipment

CONTRARY to general opinion, the average railroad shop is sold on the idea of grinding, and abrasive operations predominate in locomotive repair. This article illustrates and described briefly a few interesting grinding operations performed in locomotive rebuilding in one of the largest and most up-to-date railroad shops in the Middle West. While it is true that the shop itself is comparatively old, the greater part of the abrasive equipment is new and of approved design.

The operation shown in Fig. 1 consists of resurfacing a guide bar. These units are subjected to considerable wear. With the locomotive running forward, when the crankpin is on the top quarter, the tendency is to force the crosshead upward. With the crankpin on the lower quarter, the tendency also is to force the crosshead upward. Thus the upper guide bar is subjected to the greatest wear, and in exaggerated cases, this wear may amount to over an eighth of an inch. On switching engines, which run backward as much as they do forward, the wear on the guide bars is about equal. On any locomotive, however, the greatest wear is near the center of the guide bars, caused, of course, by main rod angularity.

The machine shown in Fig. 1 is a self-contained Hanchett face grinder. This machine is fitted with a manufactured alumina segmental cylinder wheel, 30 in. in diameter, 7¼ in. wide with a 2-in. cutting face. The grit is 24 and the grade medium, while the surface speed is 4,500 ft. per min. As Fig. 1 shows, a special fixture is employed on which two guide bars are located. The object of this design is to enable the operator to load one side of the fixture while grinding is in progress. The bars are held in place by clamping bolts. The fixture can be rotated on its base after it is loaded.

The amount to be removed in this operation depends entirely on the wear. All that is necessary is to grind the worn surface to present a true plane. Wet operation of the cylinder wheel leaves an ideal surface for the crosshead gibs to bear against. Another advantage of repairing guide bars by grinding is that only enough metal need be removed to true up the surface. The guide bars in position on the machine in question are 72 in. long and 6 in. wide. This gives an actual surface of 432 sq.in., and assuming ⅛ in. of stock to be removed, 54 cu.in. are ground away. As this is a substantial amount, it is apparent that a massive, rigidly constructed surface grinder is necessary for best results.

A good example of specialized abrasive work in railroad shops is link grinding. This practice has received considerable attention during the past decade or so, and today many highly efficient machines are employed.

Locomotive valve gear links are subjected to considerable wear from various causes. First there is the element of grit which is always present to some extent on any roadbed. Then there is a certain amount of slip between the link and its block that cannot be overcome entirely in the best designed valve gear. Further, the valve gears on modern locomotives are ponderous units in themselves. The link block is brought to bear forcibly against the link arcs alternately, that is, with each reversal of the arc motion through which the link works. The action of hooking up or reversing the gear, of course, causes wear. All factors considered, when a locomotive comes into the shop for a

Fig. 3—By means of a gap grinder piston rods are refinished without removing the piston

thorough overhauling, the valve gear links always are in need of repairs.

The Sundstrand machine, shown in Fig. 2, was designed and built especially for link grinding. The link in process of grinding is located in a special fixture which in turn is mounted on a platen that is actuated by a pendulum motion. It is, of course, necessary to grind the link to the desired radius. This is taken care of by adjusting the fulcrum on which the pendulum motion swings. The arc through which the link swings can also be adjusted for correct reversal at each end. Thus the machine takes care of a variety of links for both Stephenson and Walschaert valve motions.

Grinding is done wet with a manufactured alumina wheel, 2 in. in diameter, 4½-in. face, 36 grit, medium hard grade. This wheel is operated at a surface speed of 5,500 ft. per min. The link in position on the machine has wearing surfaces 24 in. long and 3 in. wide, while the block that fits the link is 3 in. wide and 4 in. long.

The usual procedure in link grinding is first to grind the link, removing just enough material to clean up the surfaces, and then to grind the block to fit the link. In grinding, the block is located on a special fixture and arranged so that the wheel can pass over each side.

Piston rod grinding is another important branch of railroad shop repair work. In Fig. 3 are shown two piston rods refinished by grinding. These rods are 60 in. long and 4½ in. in diameter. Piston rods are ground in a special type

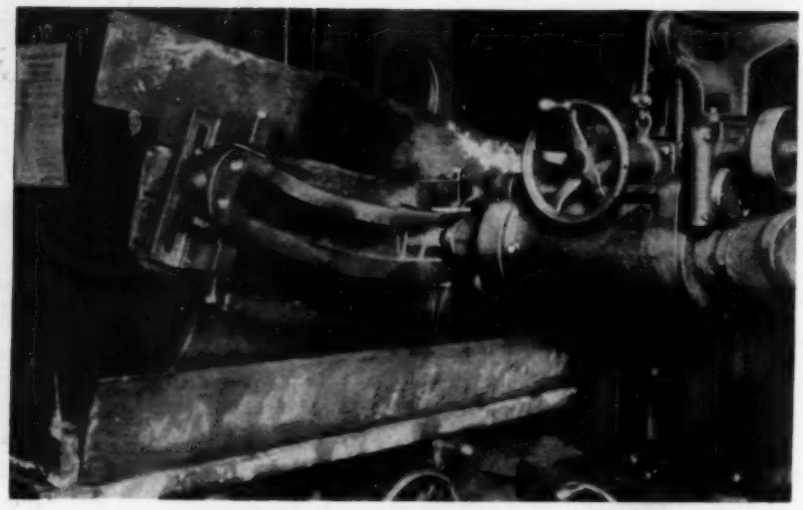


Fig. 2—A pivoted fixture with an adjustable fulcrum is employed for valve link grinding

Fig. 4—The gap grinder has become firmly established as a convenient railroad shop tool

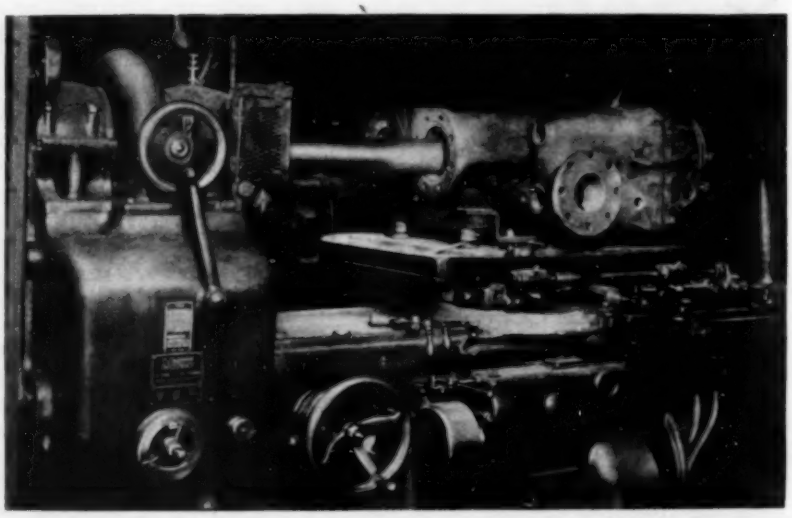


Fig. 5—Pump cylinders of various types and sizes are machined on a planetary internal grinder

of cylindrical grinder called a gap grinder because of a gap in the bed which permits the grinding of a large piston rod without removing it from the piston. The gap grinder is nothing new. In fact it is a modification of the gap lathe which has been in use for a half century. However, the gap grinder is a handy railroad shop tool.

A close-up of a Norton gap grinder is shown in Fig. 4. This machine swings 16 in. over the bed, 40 in. in the gap, and takes work 120 in. between centers. The wheel used is manufactured alumina, 24 in. in diameter, 3⅞-in. face, 24 combination grit, medium soft grade. This wheel is operated at a normal peripheral speed of 5,000 to 5,500 ft. per min.

The work in place on this machine is a piston and rod assembly for an air brake cylinder. The piston rod is 2 ft. long and 1½ in. in diameter. This is of course a small job when compared with the large units shown in Fig. 3. However, the gap grinder is used for finishing a variety of pistons. Experience has shown that the repairing of pistons by grinding assures accuracy so that the rods fit the metallic packing used today with a steam-tight fit.

In repairing any kind of a piston rod by regrinding it is usually the practice to grind it to the next standard undersize so that it will fit metallic packing already on hand.

Planetary Grinding

Repairing of various units such as feed-water pumps and air pumps by grinding on planetary type machines is an interesting branch of railroad shop repair work that has been given considerable attention during the past ten years. The machine shown in Fig. 5 is a Micro planetary type internal grinder made especially for railroad shop work. The unit shown in position on this machine is a duplex feed-water pump which is here arranged for regrinding the steam end. The water ends of such pumps are never ground inasmuch as they are fitted with brass liners according to usual pump cylinder practice. When a liner is worn unduly or badly scored, it is forced out and a new one substituted.

The pump in question is located directly on the machine table and held in place with straps and bolts. The table can be adjusted radially throughout an entire circle and can also be adjusted crosswise by a micrometer screw so that close settings can be readily made.

The pump in place on the grinder has steam cylinders 8 in. in diameter and 11 in. long. After one cylinder is aligned correctly and ground, the table is moved by the crossfeed screw to the setting for the next cylinder. The crossfeed screw graduations are relied on for accuracy in making this setting.

This machine is fitted with a wheel 5 in. in diameter, 1¼-in. face, 36 grit, medium soft grade. It is operated at an approximate peripheral travel of 5,000 ft. per min. Grinding usually is done dry with a planetary motion of about 60 r.p.m.

While the foregoing are only a few of the more interesting grinding operations performed at the shops in question, they show that grinding is playing an important part in locomotive repair shop work, and that the obsolete grinding equipment we hear so much about in railroad shops is sometimes a myth.

Upkeep Costs on Motor Trucks and Cars

Those of us who drive a car year after year with little or no expense for spare parts, are apt to be a bit staggered by the figures for spare parts given by the Automobile Chamber of Commerce. The money spent for spares totals about one-third of the cost of new cars and trucks. And this doesn't count tires at all, which run a bit over one-third. The sum of the two, more than two-thirds of the cost of new cars and trucks, goes to keeping the old ones running. With average cost of cars given as $720, the tire bill should show about $250 a year. As few of us wear out half that value in tires per year, the truck bill for tires must be in the neighborhood of $400 a year or over half the cost of the average truck. Selling a truck thus approaches the selling of safety razors, the main business being in keeping it supplied with tires and parts.

Balancing Connecting Rods for Truck Motors

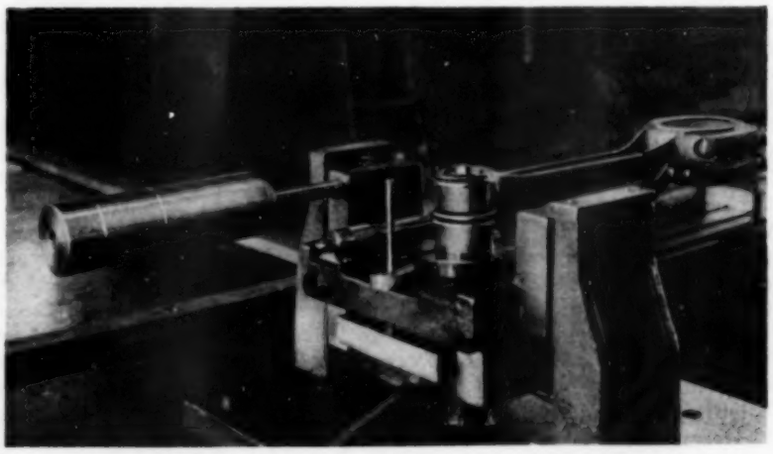
HERBERT C. FRANCIS

A good indication of the care taken in building a high class modern truck motor can be had from the way in which connecting rods are balanced in the plant of the International Motor Co. in making the Mack motor.

The balancing machine consists primarily of a platform or cradle that is supported on knife edges. A stud in the center of the cradle supports the rod, bushings being provided to fit the different sizes of rods. Placing a standard or master rod on the central stud the cradle is balanced by moving the weights in or out on the threaded bar at the left on the cradle. A sensitive spirit level shows when the cradle is level.

Using this setting as a standard, other rods are put on the stud and the balance noted by the level. As all variations are on the heavy side, the rod being checked is balanced by putting small weights on the small vertical rod. These weights are practically standard washers of such size that they represent units of 0.004 in. of metal removed from the side of the large end of the rod. The weights themselves vary so as to require from 0.004 to 0.032 in. removal of metal, and they can of course be combined in any way necessary.

Just behind the balancing device is a vertical miller with a fixture that holds the large end of the rod while the necessary amount of metal is removed to secure the balance. This miller is kept set up for this work. The metal is removed from around the large end bearing. A similar balancing device checks the weight of the small end of the rod, weight corrections being made in a similar manner.



The rod to be balanced is held on a pin in a trunnion-supported cradle. Weight to be removed is shown by small washers on the upright pin

Blank Development for Press Operations

JOHN J. McHENRY

Two previous articles, describing methods of predetermining blank diameters, were presented by B. Spector (*AM*—Vol. 73, page 389) and C. W. Hinman (*AM*—Vol. 76, page 700). The present author recommends combining the graphical and mathematical solutions

IN OUR PLANT we design and build dies for various shapes and sizes of shells and for metal varying from 0.020 to 0.125 in. We make millions of drawn shells and necessarily have frequent occasion for blank computation. Long ago we found that a predetermined blank is not necessarily the correct blank. Even a developed blank of one metal is frequently wrong when a different metal is used although the same thickness of stock is used on the same dies. The correct blank must be developed on the production dies.

The simplest form of drawn shell is a cylinder. Blanks for this can be calculated closely, but in the case of deep drawn cylindrical shells, there is a decided thickening of the shell wall because of the reduction of the blank diameter. This is controlled somewhat by the correct taper on the blank holder's face and the resistance of the press ram to springing on the first draw. Then on succeeding redraw operations the reductions should not be too great, this depending on the metal used, the gage and the die construction. Of course, it is possible to iron the walls to a definite thickness.

This ironing operation, even though mildly done, is a first class operation to avoid. The dies become excessively hot, the shells are hard to handle with bare hands, the shell and die surfaces scratch, seize and tear. Dies require constant polishing, and if badly seized, a new die is required. Practical shell drawing should never iron the stock, not only because of the reasons mentioned, but also because it rapidly hardens the shells thus requiring frequent annealing.

When drawing irregular, conical, or even straight cylindrical shells followed by hydraulic or rubber bulging, the blank diameter calculated can only be a fair approximation. It has been our experience that these shells are of necessity stretched and must be accepted so in order to produce a satisfactory appearing shell. Nevertheless, blank computation is necessary for at least four reasons: (1) that an intelligent price be quoted on an article when preparing an estimate; (2) that stock may be ordered, received and fabricated in time for delivery; (3) that the draw and redraw dies may be designed; (4) where the part is blanked and drawn, or blanked, drawn and trimmed in one operation.

It is agreed that without a sample part for weight calculation, the blank must be determined by computation of area. As to the method used, I believe B. Spector's to be too academic for most of us; it involves minute analysis of irregularly shaped cylindrical shells, followed by application and the solving of numerous formulas for the result. It is an entirely mathematical computation. In such instances, it is much simpler and safer to solve it graphically and to compute the measured dimensions

C. W. Hinman's methods are much more easily grasped and applied because of the logical sequence of developments, use of mathematics, graphs or both. These will be read, understood and applied by many, probably for the first time. There is, however, one statement with which I do not agree. Mr. Hinman says, "When a shell has a rounded corner, deduct the radius r of the corner from the diameter of the blank given in the table. The result will be the diameter of the blank for the round cornered shell." The inaccuracy of this assertion is easily proven as follows:

Asume we have a shell 2 in. diam. × 6 in. high. Blank = 7.21 in.

Assume we have a shell 2 in. diam. × 2 in. high. Blank = 4.47 in. Now let us say we require these shells each to have ¼ in. corner radius. Then instead of the 7.21 in. blank we have a 7.21 — 0.25 = 6.96 in. blank and instead of the 4.47 in. blank we have a 4.47 — 0.25 = 4.22 in. blank

Area for 7.21 — area for 6.96
= 40.8334 — 38.0508 = 2.7826 sq.in.
Area for 4.47 — area for 4.22
= 15.6942 — 13.9682 = 1.706 sq.in.

Difference = 1.0766 sq.in.

Here we have two entirely different amounts, each supposed to be the correct amount to deduct for the selfsame corner radius on shells of exactly the same diameter.

In Fig. 2 is shown the correct method, by pointing off the center of gravity and applying the Theorem of Papus.

In the drawings herewith it will be noted that we do not use the general rules for finding blank sizes but deal entirely with surface area. No trim has been allowed as this depends on the metal thickness and the method used, whether trimmed on a die or on a trim chuck. In either case, add the required amount to the shell before computation.

In Fig. 1, let: A = 4 in.
B = 12 in.

Then blank diameter

$$= \sqrt{(\text{area } 4) + (4\pi \times 12)} \times 1.128$$
$$= \sqrt{163.362} \times 1.128 = 14.417 \text{ in.}$$

In Fig. 2, the lower part of the shell must be drawn to size; then draw a 45-deg. line crossing the tangent points of corner radius. Bisect this line with line x — x. Then point off the sector in three equal spaces; the outer point is the center of gravity and from it we get dimension C. This method is shown in enlarged section of Fig. 4.

Let Fig. 2 be 4 in. in diameter, 12 in. high and 1 in. corner radius;

Area
$= A\pi E = 4\pi \times 11$ = 138.23
$= 2C\pi D = 2 \times 1.635\pi \times 1.34$ = 14.3841
= Area B = 3.1416 = 3.1416

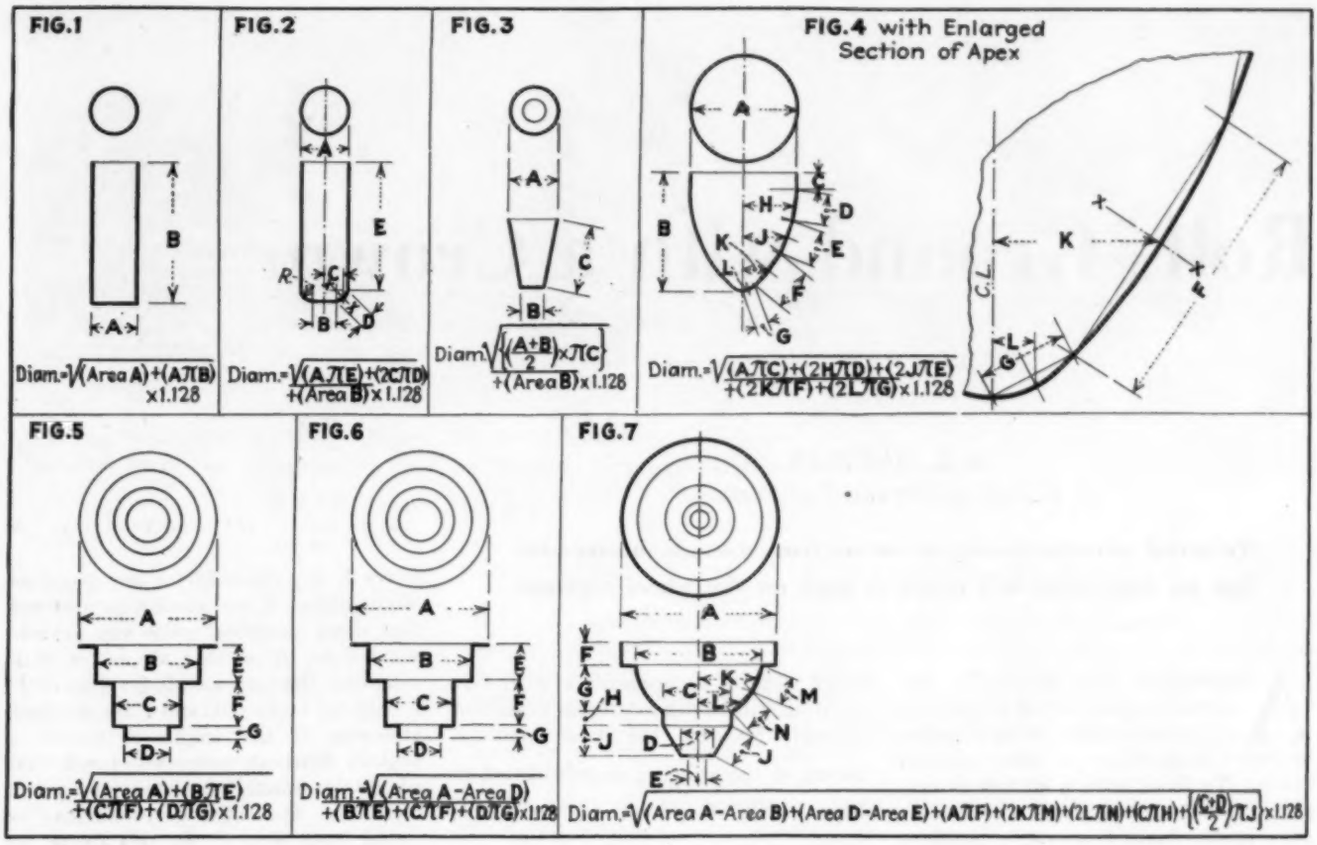
Total area..... 155.7557

Blank diameter

$= \sqrt{\text{area}} \times 1.128$

$= \sqrt{155.7557} \times 1.128 = 14.076$ in.

In Fig. 3, let A = 2 in., B = 4 in. and C = 6 in



Then blank diameter

$$= \sqrt{\left[\left(\frac{2+4}{2}\right)\pi \times 6\right] + (\text{area } B)} \times 1.128$$

$$= \sqrt{56.5487 + 3.1416} \times 1.128$$

$$= \sqrt{59.6903} \times 1.128 = 8.787 \text{ in.}$$

In Fig. 4, let

$A = 9\frac{1}{2}$ in., $B = 10$ in., $C = 1\frac{1}{2}$ in., $D = 3\frac{3}{4}$ in., $E = 3$ in., $F = 2\frac{1}{2}$ in., $G = 1\frac{1}{4}$ in., $H = 4\frac{3}{4}$ in., $K = 1\frac{7}{8}$ in. and $L = \frac{7}{8}$ in.

This shell must be drawn to size and one side struck off in any number of sectors, about as shown in the enlarged view. Then, as previously explained, bisect these sectors and point off in three equal divisions on line $x - x$. The outer point is the center of gravity and is the point from which the dimensions to the center line are scaled. Dimension F is also obtained by scaling the full size drawing. With this graphic layout compute the blank area according to the Theorem of Papus, or in other words, work out the simple formula, the greater proportion simply amounting to references to *American Machinist's Handbook* tables of areas and circumferences.

Area

$= A\pi C = 9\frac{1}{2}\pi \times 1\frac{1}{2}$	=	43.5896
$= 2H\pi D = 2 \times 4\frac{3}{4}\pi \times 3\frac{3}{4}$	=	92.78326
$= 2J\pi E = 2 \times 3\frac{3}{4}\pi \times 3$	=	63.6173
$= 2K\pi F = 2 \times 1\frac{7}{8}\pi \times 2\frac{1}{2}$	=	29.4524
$= 2L\pi G = 2 \times \frac{7}{8}\pi \times 1\frac{1}{4}$	=	3.09267
Total area	=	232.53523

Blank diameter

$$= \sqrt{232.53523} \times 1.128 = 17.2 \text{ in.}$$

In actual practice, this shell was drawn in steel from a 17-in. blank and drawn in brass from a 16½-in. blank.

In Fig. 5, let

$A = 12$ in., $B = 9$ in., $C = 6$ in., $D = 3\frac{3}{4}$ in., $E = 3$ in., $F = 3\frac{3}{4}$ in., $G = 1\frac{1}{4}$ in.

Then diameter

$$= \sqrt{(\text{area } 12) + (9\pi \times 3) + (6\pi \times 3\tfrac{3}{4}) + (3\tfrac{3}{4}\pi \times 1\tfrac{1}{4})} \times 1.128$$

Area 12	=	113.1
$9\pi \times 3$	=	84.823
$6\pi \times 3\frac{3}{4}$	=	70.6858
$3\frac{3}{4}\pi \times 1\frac{1}{4}$	=	13.2536
Total area	=	281.8624

Blank diameter

$$= \sqrt{281.8624} \times 1.128 = 18.937 \text{ in.}$$

In Fig. 6, with the exception of Area A—Area D, all computations are similar and need no example.

In Fig. 7, we have a most irregular shape of cylindrical shell, embracing all the elements of each previous example. The solutions are worked on in exactly the same manner as heretofore, and my reason for adding this illustration is to show the application of the graphic and mathematical solution. This shell must be drawn to scale and dimensions K, L, M and N scaled from the drawing. With this chart and accurate drawings where necessary, a blank can be determined according to area for any round shell.

There are, of course, cylindrical shells having local extensions or formations on their contour, and other types of drawn or formed parts that may require strategically located additional draw beads—this in addition to the draw bead which is sometimes required. The location and necessity for these is found only through experience, and naturally blanks for such types of shell are found only by developments.

Automotive Freight on the Railroads

While motor vehicles undoubtedly take a lot of business away from the railroads, they also turn a lot of business to the railed carriers. Even in 1932, which was a pretty shy year in most ways, 2,570,000 carloads of automotive freight went to the railways. This is a lot of freight, almost one ton for each truck registered. And the great majority of trucks do not haul freight in competition to railroads, but rather carry freight or express to and from the railroad station, replacing the horse, but not the locomotive and cars.

Rolls Ground with a Crown

A. L. HARTLEY
R. K. LeBlond Machine Tool Company

To grind an entire family of curves from a single master cam bar an adjustable bell crank is used on the wheel carriage

A PROBLEM that frequently confronts designers is that of finishing cylindrical surfaces with a camber or crown conforming to some specified curve. To finish such a surface is simply a matter of connecting a cross slide to a profile bar. However, a machine is seldom designed to reproduce a single curve; usually it must be designed to produce a family of curves of the same type.

A specific problem recently submitted to The R. K. LeBlond Machine Tool Company was that of finishing composition covered steel rolls which varied in diameter from four to twenty-four inches and in length from six to sixteen feet. These rolls were to be finished convex and to have a curvature in accordance with an elastic curve. It was specified that the maximum deflection would not exceed one-tenth inch.

Before any attempt was made to design this machine, the following analysis was made:

The equation for the elastic curve is:

$$Y = \frac{W X}{24 EI}(L^3 - 2 L X^2 + X^3) \quad \ldots (1)$$

Where:

- Y = deflection from the horizontal supporting axis at any point along the curve (in inches),
- X = longitudinal distance from one end of the curve to any point along the curve (in inches).
- E = modulus of elasticity (29,000,000 for steel),
- I = moment of inertia, 0.049087 $(d^4 - d_1^4)$,
- W = pressure in pounds on the roll, per inch of length,
- L = length overall (in inches),
- d = outside diameter of steel tube (in inches),
- d_1 = inside diameter of steel tube (in inches).

It can readily be observed that a roll which deflects in accordance with this equation will have a maximum deflection midway between the two supports. Hence, if the value $\frac{L}{2}$ is substituted in Equation 1, it reduces to the simple form:

$$Y_{max.} = \frac{5 W L^4}{384 EI} \quad \ldots (2)$$

From Equation 2 it may readily be observed that rolls of different diameters will require varying curvatures because of the factor I. It may also be observed that the length of the roll and the pressure under which it works will affect the amount of camber required. If the equation is set up in the form:

$$Y = \frac{W X}{24 EI}(L^3 - 2 L X^2 + X^3) \quad \ldots (3)$$

$$Y' = \frac{W' X K}{24 EI}(L^3 - 2L X^2 + X^3)$$

where K is a constant for any given set of conditions, it can readily be observed that some numerical value can be substituted for K so that all values of Y will equal the corresponding values of Y' if only the factors W and I are changed. However, if the length is varied, a slightly different curve will result that cannot be exactly corrected for by this constant. The slight deviation may be noted from Fig. 1. In this figure, an elastic curve was calculated as follows: Assume the roll to be:

16 ft. between supports,
1 in. maximum deflection.

Known:

$$Y_{max.} = \frac{5 W L^4}{384 EI}$$

$$Y = \frac{W X}{24 EI}(L^3 - 2 L X^2 + X^3)$$

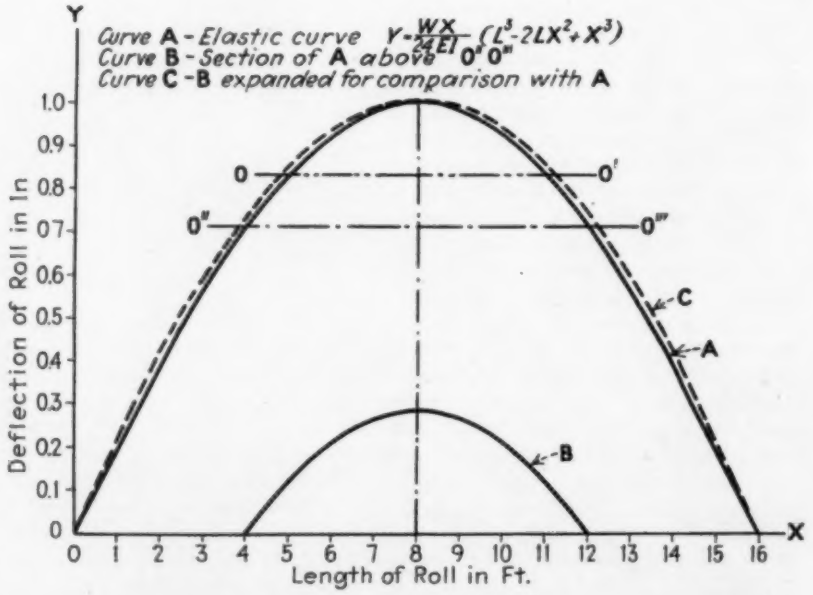


Fig. 1—A graphical layout shows that only a small error is incurred when Curve B is expanded for both ordinate and abscissa

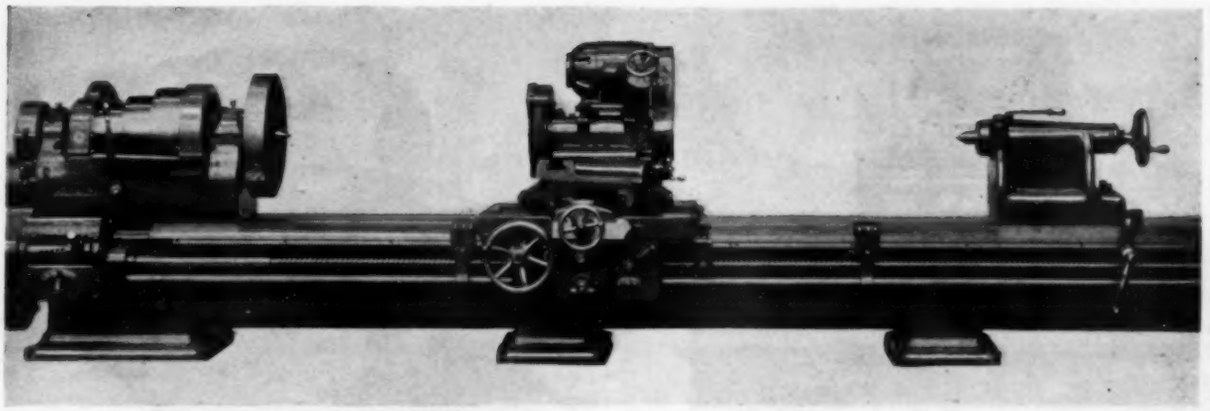


Fig. 2—This lathe, specially arranged for crown grinding, uses many standard parts and may also be used for ordinary turning operations

Solution:

Let $\frac{W}{24\,EI} = C$, a constant for a given set of conditions.

$$Y = C\,X\,(L^3 - 2\,L\,X^2 + X^3)$$

$$\frac{1}{12} = 8C\left[16^3 - (2 \times 16 \times 8^2) + 8^3\right]$$

$$C = 0.00000407$$

$Y^1 = 0.00000407 \times 1\,[16^3 - (2 \times 16 \times 1) + 1] \times 12 = 0.19837$ in.

$Y^2 = 0.00000407 \times 2\,[16^3 - (2 \times 16 \times 2^2) + 2^3] \times 12 = 0.388$ in.

$Y^3 = 0.00000407 \times 3\,[16^3 - (2 \times 16 \times 3^2) + 3^3] \times 12 = 0.5614$ in.

$Y^4 = 0.00000407 \times 4\,[16^3 - (2 \times 16 \times 4^2) + 4^3] \times 12 = 0.71208$ in.

$Y^5 = 0.00000407 \times 5\,[16^3 - (2 \times 16 \times 5^2) + 5^3] \times 12 = 0.8347$ in.

$Y^6 = 0.00000407 \times 6\,[16^3 - (2 \times 16 \times 6^2) + 6^3] \times 12 = 0.9252$ in.

$Y^7 = 0.00000407 \times 7\,[16^3 - (2 \times 16 \times 7^2) + 7^3] \times 12 = 0.98073$ in.

$Y^8 = 1.000$ in.

Since the curve is symmetrical, it is not necessary to solve for the other values.

If a section four feet on each side of the center of this curve is assumed and reproduced on the base line of the original curve, it will appear as curve *B*, Fig. 1. Since the equation of a curve does not in any way determine the scale of the abscissa or ordinate to which the curve is plotted, it may readily be observed that, if the scale of the ordinate is multiplied by a factor that will cause the point of maximum deflection of the small curve to fall on the point of maximum deflection of the large curve and the scale of the abscissa is multiplied by a factor that will make the base of the small curve equal to the base of the large curve, Curve *B* would be superimposed on Curve *A* if the expanded section is a true elastic curve. Since the length assumed for the second curve is eight feet, the abscissa should be multiplied by the factor two. The required factor for the ordinate may be obtained as follows:

Subtract the ordinate four feet from the end of Curve *A* from the ordinate eight feet from the end of Curve *A*. This gives the maximum ordinate of Curve *B*. Divide the maximum ordinate of Curve *A* by the maximum ordinate of Curve *B*. Curve *C* is shown in dotted lines and shows the slight deviation from the true elastic curve which would be obtained only by using a section of the master cam bar.

The effect of this difference can be more clearly shown by a numerical example. The length of rolls usually ground varies from six to sixteen feet. If the cam bar is designed for a 16-ft. curve and a maximum deflection of one inch, and a roll six feet long is to be machined, the greatest effect of length change will exist.

The following solution will illustrate the slight error.

Given:

Weight of steel = 1.39 lb. per in.
Weight of composition = 0.416 lb. per in.
Total uniform load = 1.806 lb. per in.
$E = 29{,}000{,}000$ $I = 1.91$ $L = 72$ in.

Assume that the roll deflects only because of its own weight and neglect the effect of the composition on the terms *E* and *I*. Solution:

$Y_0 = 0$

$$Y_1 = \frac{1.806 \times 12}{24 \times 29 \times 10^6 \times 1.91}\left[72^3 - (2 \times 72 \times 12^2) + 12^3\right] = 0.00577 \text{ in.}$$

$$Y_2 = \frac{1.806 \times 24}{24 \times 29 \times 10^6 \times 1.91}\left[373248 - (2 \times 72 \times 24^2) + 24^3\right] = 0.00944 \text{ in.}$$

$$Y_3 = \frac{1.806 \times 36}{24 \times 29 \times 10^6 \times 1.91}\left[373248 - (2 \times 72 \times 36^2) + 36^3\right] = 0.0114 \text{ in.}$$

Since only a 6-ft. segment of the cam bar is to be used, a base line 0 0′ Fig. 1 may be constructed. For this segment, the maximum deflection = 1 — 0.8347 = 0.1653. The maximum deflection of the roll is 0.0114 in. Therefore $K' \times 0.0114 = 0.1653$ and $K' = 14.5$, the constant by which each ordinate on the form bar must be divided to equal the corresponding ordinate on the roll.

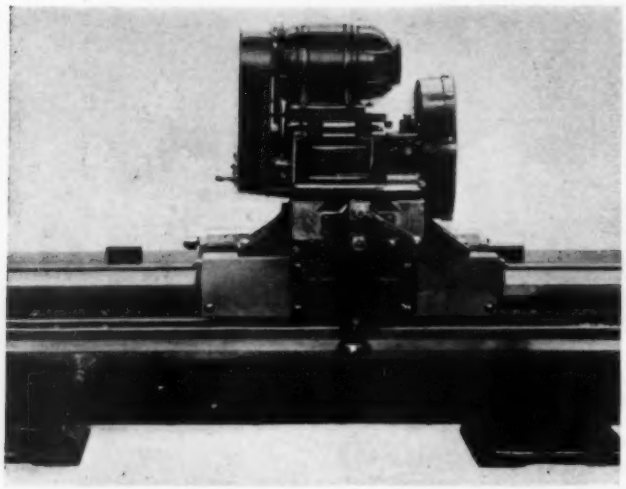
The deflection of the cam bar at the point corresponding to Y_2 is 0.14603, at the point corresponding to Y_1 is 0.905.

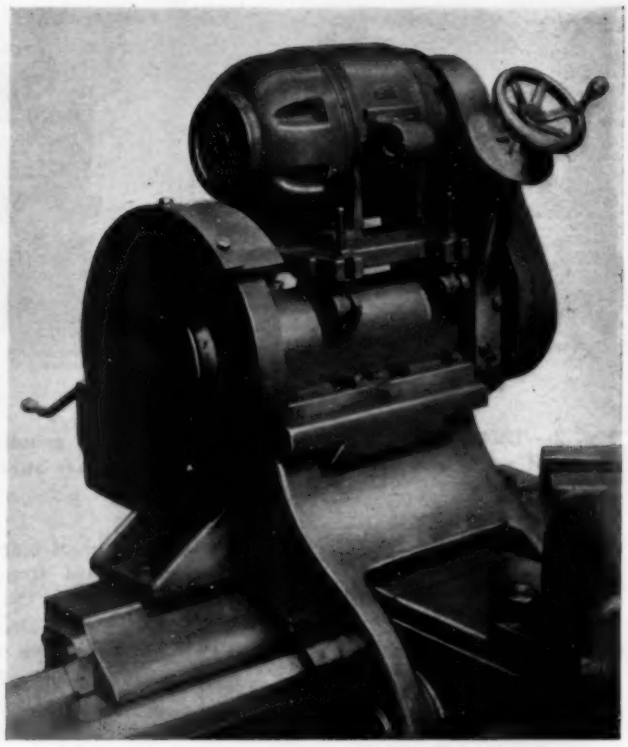
Therefore:	Actual deflection obtained	Desired deflection	Error
$Y_0 = \frac{0}{14.5}$ =	0	0	0
$Y_1 = \frac{0.0905}{14.5}$ =	0.00623	0.00577	0.00046
$Y_2 = \frac{0.14603}{14.5}$ =	0.0101	0.00994	0.00016
Y_3 =	0.0114	0.0114	0

Maximum Error

If a large deflection is assumed on a short roll, it can be shown similarly that the error will be much greater. An example was assumed where a roll 6 ft. long had a maximum deflection of 1 in., and it was found that the error of a curve of this magnitude would be as great as 0.040 in. However, since the previous example showed small errors in the actual working range, it can readily be observed that a single cam bar can be used for all of the rolls if some means can be provided whereby the ratio of the movement of the grinding wheel to the movement of the cam follower can be changed and the center of the cam can be aligned longitudinally with the middle of the roll.

With this analysis as a basis, the machine illustrated was developed. The rear view of the carriage shows clearly the construction of the cambering attachment. A long steel bar is set in a heavy frame so the curvature is accu-





Figs. 3 and 4—Two views of the carriage show the wheel mounting and the means for adjusting the bell crank and cam bar

rately adjusted in accordance with Equation 1:

$$Y = \frac{W X}{24 EI} (L^3 - 2LX^2 + X^3)$$

The cam bar is mounted on a heavy dovetail slide on the bed. A rack and pinion arrangement permits the entire unit to be moved longitudinally along the bed so that the center of the cam bar may be aligned with the middle of the roll. A clamping device is so constructed that it is impossible for the cam bar to shift when locked in position.

The cam follower consists of a heavy bell crank. One arm carries a roller which is held in contact with the cam bar by a heavy coil spring. The other arm carries a hardened and ground steel plate which contacts a heavy roller mounted on the lower part of the grinder carriage. This contact roller may be moved relative to the axis of the bell crank in such a way as to vary the ratio of its vertical movement to the movement of the cam follower from approximately 0 to 1, to 0.5 to 1. This arrangement provides for the factor K used in the previous analysis.

A heavy hinged casting carries the grinding attachment. Hence, when the bell crank lifts the contacting roller, the grinding attachment is moved in an arc about the pivot point in the bridge of the carriage. This action moves the wheel into the work through an arc. However, since the linear travel of the wheel is small (never over $\frac{1}{16}$ in.), the error introduced by this method of actuating the grinding wheel is so small that it does not appreciably affect the work.

The grinding head is mounted on a top slide which in turn is mounted on the heavy hinged bracket by means of a dovetail slide. The grinding wheel may be accurately positioned by means of a graduated dial mounted on a shaft which is geared to a crossfeed nut. The crossfeed nut is revolved by a worm gear and is accurately positioned by ball thrust bearings.

The bed is an extra heavy casting with extra wide shears, thus insuring the necessary support to the grinding attachment. The other units are essentially standard LeBlond parts.

The change of set-up is simple. The grinding wheel is aligned longitudinally with the middle of the roll to be finished. The cam bar frame is moved along the back of the bed until the center of the cam is in alignment with the center of the follower roller. At this position, the hardened contact plate on the cam follower bell crank is horizontal, and the grinding attachment will not be rotated about the pivot point in the bridge of the carriage by moving the contact roller. The contact roller is moved in on the bell crank plate until it is approximately over the center of the pivot pin, and the wheel is moved in until the roll is ground to the desired diameter.

The position of the dial is noted and the slide withdrawn so that the wheel is clear of the work. The carriage is moved along the bed to the end of the roll, and the grinding attachment cross slide is returned to the same setting as before. The cam follower contact roller is then adjusted so that the roll is ground to the correct size. Since the cam follower bell crank plate is horizontal when the grinder is in the middle of the roller, the fact that the contact point was moved on the plate will not change the diameter ground on the roll from that in the trial setting. The roll can then be ground in accordance with conventional methods.

Although the machine illustrated is special, it is equipped with a regular compound rest and can be used for regular lathe work by withdrawing the top slide of the grinding attachment.

Precautions in Surface Grinding

CHARLES WESLOW

When I have a fine job of grinding to do, with the work held on a magnetic chuck, I always rub a fine abrasive stone over the surface of the chuck to remove particles of metal and abrasive that may have adhered to it from previous jobs. Then before mounting the work, I lay a sheet of paper on the face of the chuck. If the work has a finely finished surface, the paper prevents the finish from being scratched.

While the work can be more easily removed from the chuck when paper is between the surfaces, the paper does not stop the flow of magnetic current to any noticeable degree.

Quick-Drying and Enduring Finishes

HERBERT CHASE
Consulting Engineer

Extensive experiments during the past few years have demonstrated beyond question that paints which are exceedingly durable as well as quick-drying can be made with various synthetic resins. Some of these resins are liquids which dry by oxidation, much as do linseed and tung oils, but more quickly and with a degree of durability not attained by other vehicles. Certain of the resins are also mixed with drying oils to which they impart unusal toughness, quick-drying and weather-resistant qualities.

Durability

One reason for their durability in outdoor applications is that some of these resins are opaque to ultra-violet light which is an important factor in the deterioration of all finishes exposed to the light of the sun. This characteristic is of special importance in clear finishes but also greatly delays the chalking of pigmented finishes and enables them to hold their gloss for much longer periods of outdoor exposure.

One class of paints especially well suited for exterior applications contains modified glycerol phthalate resins more generally termed rezyls. The latter may constitute the sole film-forming binder or may be combined with drying oils. Such oils help to improve working qualities.

Paints made with rezyl gums usually air-dry under good conditions so as to be dust-free in three to four hours and may be recoated in seven to eight hours. Baking will shorten the drying time to about one hour. Such paints have excellent adhesion to either metal or wood and do not readily scale or blister. Rezyl primers and sealers or surfacers are now extensively used on automobile body and other metal work, either under lacquer finishing coats or under finishes of other types which themselves often contain rezyl components.

Among the most important uses of rezyl paints is their application to freight cars, tanks and other exterior metal or wood surfaces. Such paints may be mixed with iron oxide, or other rust-inhibitive pigments, or with aluminum bronze. A good rezyl paint for freight cars contains 100 lb. of iron oxide paste having a 25-per cent linseed oil content; 42 lb. of rezyl No. 110; 18 lb. of xylol; 8 lb. of liquid dryer (consisting of 1 lb. of lead linoleate and ½ lb. of manganese linoleate dissolved in turpentine) and 59 lb. of naptha or mineral spirits. The proportions of rezyl and thinner depend upon the spray equipment available, and the paint should be mixed by a manufacturer familiar with rezls and their use. For brush application, another of the rezyls would be selected.

Such paints are suitable either for new work or for refinishing, assuming of course that the surface finished is properly cleaned. Because of their quick-drying properties, a second coat can often be applied the same day. In a railroad shop, this materially reduces the space required for refinishing. Cars may be run out into the open soon after finishing, as the paint sets quickly and does not wash off even if exposed to heavy rain after setting has started. When dry, this paint possesses the toughness and good weathering qualities already referred to and holds its gloss for long periods.

Weather Resistance

Some of the phenolic resins are also extremely enduring under weathering conditions and are extensively used in exterior varnishes and enamels. This class includes what are probably the most highly moisture-resistant finishes generally available. The phenolic resins also promote quick drying and are used in many of the quick-drying varnishes and enamels that have largely replaced brushing lacquers. Both phenolic and glycerol phthalate resins are employed in the formulation of lacquers which, of course, dry faster than any of the commoner finishes and are especially well suited for automotive and certain other uses.

Another form of modified glycerol phthalate resins, termed teglacs, which lack the toughness and the ability to withstand weathering characteristic of the rezyls, is coming into extensive use for interior finishes. The teglacs impart hardness to the film and, especially in the case of clear finishes, produce an exceptional depth of luster. They are used mostly in lacquers but are applied also in combination with rezyls to help form a harder film when extreme resistance to weathering is not required.

Certain of the saturated phthalate resins, forming one distinct class of rezyls, are especially well suited for lacquers exposed to the weather, for in common with the oxidizing type of rezyl, they are opaque to ultra-violet light. They can be used, therefore, for making clear exterior finishing lacquers, whereas the older forms of clear lacquers made with natural resins perished quickly when exposed to sunlight. This group of resins is not confined to clear lacquers, however, but finds extensive use in pigmented lacquer enamels to which they impart an enduring gloss and retention of color. In some cases, they permit of fewer costs and savings both in labor and in material.

Polishing Unnecessary

An important advantage secured by the use of certain rezyls in the last mentioned class is that the final coat can be sanded after an initial period of force drying to free it from specks and "orange peel." Heretofore, after this operation one or more mist-coats, containing a large percentage of solvent to run out the sanding scratches, was necessary before final polishing. With the rezyl rightly selected and proportioned, however, the finish is again baked at a temperature sufficiently high to soften the surface of the finish enough to flow out the scratches. This final bake, which requires 45 min. to one hour, leaves the surface with a hard brilliant luster; hence none of the expensive polishing formerly required is necessary. The net result is an economical and highly enduring finish which, in appearance and depth of luster, resembles the old-fashioned color varnish but is much tougher, more resistant to scratching and longer lived.

This type of finish is especially suited for sheet-metal parts and can be applied in a single coat with good results when the metal is smooth and minimum cost is essential. For better grades of work, however, a baked priming coat should precede the enamel, and one or two double-cross-spray coats with a 15-minute interval between them should be applied. Much single-coat work in the less expensive grades of sheet enamel ware is now done in this way, especially in white. Some of the rezyls show practically no after-yellowing as a result of baking or prolonged aging.

Most progressive manufacturers of finishes produce many types in which the various synthetic resins are employed this quality suits them particularly for use with white and light-colored pigments, although they are equally satisfactory with most dark colors.

Acme Screw Threads and Tools

WILLIAM WHITNEY

SO FAR as I know, no one has made any sort of a genealogical chart of a screw, showing its relatives and dependents, but the chart illustrated tells that kind of a story. It was made primarily to help visualize the numerous relationships of the various tools and screw dimensions with each other. When only one or two factors are considered there is little chance for error, but when a number of details or their more distant relationships are discussed, this chart minimizes the possibility of error in a practical way. The tabulation gives basic dimensions which are much used and around which limits, clearances and other dependents are discussed pro and con in many shops.

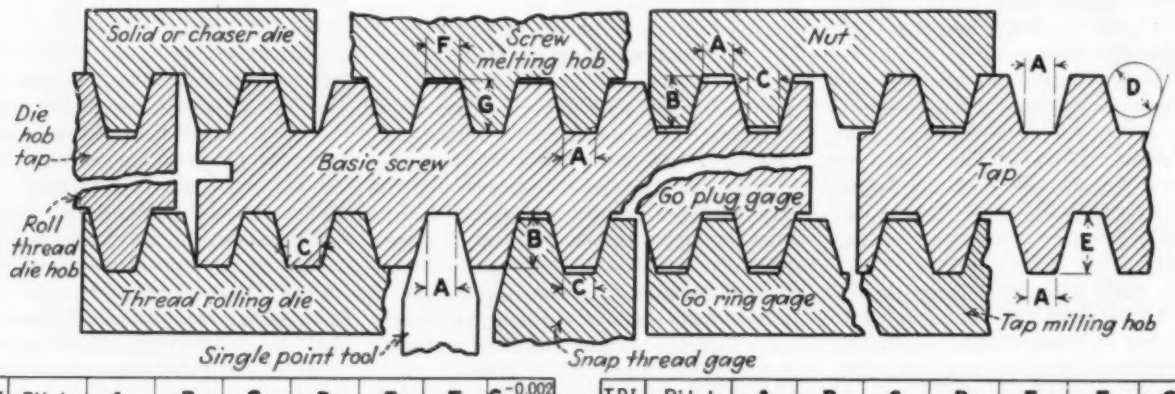
The chart is largely self-explanatory but a few words may serve to clarify some of the details. The milling hobs shown are really circular grooved milling cutters. These are used for taps, roll thread dies and their laps, plug gages, etc., as well as screws, because the milling method of threading is so common.

No data are given for many other tools to make these tools, such as special milling hobs with lead, "not-go" gages, masters, laps, ring gages, taps, plain plugs and rings. But these can readily be visualized and working data derived with the aid of the assembly illustrated. This includes hardening allowances for lead, also truncations, clearances and tolerances, keeping in mind the different tools and methods of manufacturing all around the screw. Standardization nationally and individually should be considered with a broad vision.

Questions such as these arise when standardization or manufacturing methods are being developed:

Shall the basic thread section or space on the Acme standard be nominal or axial? If all screws were made with single-point tools and single-thread milling cutters this would not be difficult, but when hob milling is thought of, the discussion commences. As in other thread systems the axial tooth and space of 29 deg. basic is much to be desired. Shall 0.010 in. clearance be used at the major and minor diameter for 12 pitch as well as for 3 pitch? Do we have any such disproportionate clearance on other thread standards? How about the weakening of the core on a ⅜ in.—12 pitch? Look at the thread rolling die; think of the extra metal displacement and then straighten out this matter.

Shall Acme form be changed to worm



T.P.I.	Pitch	A	B	C	D	E	F	G $^{-0.002}_{+0.001}$
1	1.00000	0.3655	0.5100	0.3707	0.500	0.5200	0.3691	0.5130
1⅓	0.75000	0.2728	0.3850	0.2780	0.400	0.3950	0.2765	0.3880
1½	0.66667	0.2419	0.3433	0.2471	0.350	0.3533	0.2456	0.3463
2	0.50000	0.1802	0.2600	0.1853	0.250	0.2700	0.1838	0.2630
2½	0.40000	0.1431	0.2100	0.1483	0.220	0.2200	0.1467	0.2130
2⅔	0.37500	0.1338	0.1975	0.1390	0.200	0.2075	0.1375	0.2005
3	0.33333	0.1184	0.1767	0.1236	0.180	0.1867	0.1220	0.1797
3½	0.28571	0.1007	0.1529	0.1059	0.160	0.1629	0.1044	0.1559
4	0.25000	0.0875	0.1350	0.0927	0.130	0.1450	0.0911	0.1380
4½	0.22222	0.0772	0.1211	0.0824	0.120	0.1311	0.0808	0.1241
5	0.20000	0.0689	0.1100	0.0741	0.110	0.1200	0.0726	0.1130
5⅓	0.18750	0.0643	0.1038	0.0695	0.100	0.1138	0.0680	0.1068
5½	0.18182	0.0622	0.1009	0.0674	0.100	0.1109	0.0658	0.1039
6	0.16667	0.0566	0.0933	0.0618	0.090	0.1033	0.0602	0.0963
7	0.14286	0.0478	0.0814	0.0530	0.080	0.0914	0.0514	0.0844

T.P.I	Pitch	A	B	C	D	E	F	G
8	0.12500	0.0411	0.0725	0.0463	0.070	0.0825	0.0448	0.0755
9	0.11111	0.0360	0.0656	0.0412	0.060	0.0756	0.0396	0.0686
10	0.10000	0.0319	0.0600	0.0371	0.060	0.0700	0.0355	0.0630
12	0.08333	0.0257	0.0517	0.0309	0.045	0.0617	0.0293	0.0547
14	0.07143	0.0213	0.0457	0.0265	0.040	0.0557	0.0249	0.0487
16	0.06250	0.0180	0.0413	0.0232	0.035	0.0513	0.0216	0.0443
20	0.05000	0.0133	0.0350	0.0185	0.030	0.0450	0.0170	0.0380

$A = 0.370691\,P - 0.005172$
$B = 0.5P + 0.010$
$C = 0.370691\,P$
$E = 0.5P + 0.020$
$F = 0.370691\,P - 0.001552$
$G = 0.5P + 0.003$

thread form as some manufacturers use it? Isn't it true that there is a distinct demand for shallower rather than deeper threads? The latter demand at present comes mostly for square or modified square threads which could well be served by the 29-deg. thread. Shall the screws and nuts have clearance at the minor diameter or shall a guiding action which amounts practically to a bearing, be made between them? Consider how small the field for nuts and screws that need to be guided; they really are not nuts and screws in the ordinary sense but long lead screws which need a central support. Compare those few cases with the valve threading industry alone and many kindred fields. Then, too, look at the other tools on this drawing. Think of the accuracy required at the minor diameters and the increased cost? There are cases where it is desirable to make a tap that will remove the burrs in the minor diameters of the nuts, but high-speed, free-cutting and perhaps ground taps leave practically no burrs compared with the hard cutting, or rather metal-pushing, taps of old as well as many homemade taps of today. This guiding action at the minor diameter is detrimental to the large field of Acme screw users where the screw must seat itself, because shake, not a snug fit, is very necessary.

Two Standards Needed?

Shall we recommend more than one standard, say a coarse and fine pitch? The present preliminary standard now published (National Screw Thread Commission) specifies a 4½-in. diameter, 1-in. pitch thread. How many of these larger sizes of Acmes are used compared to the number for valves, jacks, presses and feed screws in machine tools?

The smaller diameters and pitches should be made to cover the field more thoroughly than at present. For instance, many Acme screws are made single, double, triple and quadruple; the standards from the beginning should tentatively cover this field. Would it not then be best to err on the side of a few extra sizes in the standard and eliminate the unlimited confusion and variety which exists at present? The diameters and corresponding pitches while being reconsidered might well be made to cover the entire field more thoroughly. Perhaps the lead screw and feed screw field for machines was not carefully considered. For instance, in the national thread system the sixteenth sizes like 1⅛ and 1⅜ in. have been left out, yet in the design of feed screws for aprons one sixteenth larger in diameter often gives ample strength and rigidity. When designing, it is not possible to give up the room or space for an enlarged screw and nut when it steps up by a full ⅛ in. To give the designer a choice and a chance the Acme sizes should step up by ⅛ in.

In covering the field of screws that must shake in their nuts and lead screws which transmit motion, it will be necessary of course to have more than one class of fit. Doesn't it seem as if the number of classes of fit could be reduced and the range of diameters and pitches increased, and thus cover the field satisfactorily and put an end to the mountain of freakish specifications which are sent out at present? When one looks at the chart and thinks of the tool cost for each standard, it will be evident that the fewer there are the more the savings will be for manufacturers and customers, provided only that the field is well standardized.

Why is the maximum Acme below basic when in our standard national system the maximum screw is basic and the limits taken down? Why should not the Acme system be consistent with the regular thread system? In our standard 60-deg. system the taps for the nuts are made to vary in diameter to produce the clearance desired.

How can a few men grapple with this problem? Others who read this should send in their experiences and desires; the more that agree, the less the criticisms and corrections later.

How Hot Bearings?
Discussion

M. P. DALTON
Sevenoaks, Kent, England

It is doubtful whether anyone can answer Godfrey's query (*AM*—Vol. 76, page 1171) as to the proper running heat for a bearing. The sight of water boiling like a geyser on the bearings of the average ocean liner's propeller shaft would shock many engineers who like cool bearings.

A motorcycle, two-stroke engine was very carefully finished in all its details and assembled. That machine performed best—and did so for many thousands of miles—when all the top half of the cylinder was bright red hot in spite of a fifty mile an hour air stream to cool it.

During a strike of electrical workers in Dublin, the Telegraph and Telephone exchange generators were run for hours by standard motor cycles, with makeshift fan cooling. Sometimes the fan stopped. Within a second, the cylinder top and exhaust pipes glowed red; the inside was perhaps red all the time. Some of these ran without a stop for twenty hours and with no unusual wear.

How Hot Bearings?
Discussion

GILBERT G. COOMBS

The question "how hot bearings," raised in your "Seen and Heard" column (*AM*—Vol. 76, page 1171) opens a subject upon which much could be written. The factors which determine the maximum safe temperature of bearings are so diversified as to create a number of classes. I have in mind two extremes with which I am in daily contact; one, a battery of pumps whose bearings have a normal temperature of approximately 700 deg. F., and the other a battery wherein a bearing temperature in excess of 150 deg. F. would be cause for immediate investigation. The first battery consists of rotary pumps handling asphalt at 750 deg. F., and the cast-iron bearings are lubricated at a pressure of 60 lb. per square inch with this material. The other battery of pumps handle gasoline, and for obvious reasons the bearings must be closely watched.

It is apparent then, that the temperature of a bearing, friction heat neglected, is limited only by the temperature of fusion of the bearing material. As regards friction heat, the danger point is reached only when the heat is produced faster than it can be dissipated, and this holds true even when the dissipation is assisted by water-jackets or other methods.

Where the normal bearing temperature does not exceed about 200 deg. F., detection of abnormal heat is, of course, quite simple. In bearings running above this temperature, but lubricated in the usual manner, detection becomes more difficult, the first definite sign being partial combustion of the lubricant, when only immediate action can save the bearing.

High bearing temperatures, such as the ones mentioned as running at around 700 deg. F., are, I believe, unusual. It has been my experience that it is virtually impossible to detect excessive friction heat in this class of bearing in time to prevent damage, the first and only sign being a seized shaft.

Operators become accustomed to the normal temperatures of the bearings in their care, and it is a good policy to have a machine shut down immediately abnormal heat is noticed, without having the operator decide how hot it should become before taking action. In nine cases out of ten the bearing will need the services of a mechanic. Of course this policy is not applicable to machinery which cannot be readily shut down; however, operators on this class of work are usually skilled in the art of "nursing" hot bearings, and can tell by experience when heat production begins to get the better of heat dissipation.

Load-Carrying Capacity of Extreme Pressure Lubricants

IN RECENT years certain types of gears and other mechanisms have been developed with operating pressures on the working surfaces so high that ordinary mineral lubricants will not provide sufficient lubrication for satisfactory operation. Hence, extreme pressure lubricants have become necessary. Factors that determine the performance characteristics of a mechanism lubricated with an extreme pressure lubricant may be divided into three general classes: namely, design factors, operating factors and lubricant characteristics. In gears, the design factors of importance are dimensions, tooth design and material. The operating factors of interest are load, speed and temperature. Characteristics of the lubricant of most significance are load-carrying capacity, tendency to cause or prevent wear, corrosiveness and stability.

During the past year the U. S. Bureau of Standards, at the request of the S.A.E. Lubricants Research Committee, has undertaken a comprehensive study of the problem of extreme pressure lubricants. The investigation commenced with a study of the performance of four commercial laboratory machines for measuring the load-carrying capacity. Nine lubricants were chosen as being representative of the various types of extreme pressure lubricants. One of these lubricants is a straight mineral oil, S.A.E. 70, which is used as a basis for comparison. Information as to the types of these lubricants is given in Table 1. In all four of these machines the load-carrying capacity is determined by observing the load necessary to produce seizure when applied to two steel surfaces rubbing together at constant speed and lubricated with the lubricant under test. In each machine, however, at least one pertinent feature of design or test procedure differed widely from that of the others. Accordingly, two of the machines are modified to obtain data over fairly wide limits of speed and temperature. Fig. 1 shows relative loads at seizure for the various lubricants at various speeds and temperatures. The results of all these tests lead to the following conclusions:

1. The four lubricant testing machines do not rate the lubricants in the same order.

2. The load-carrying capacity of an extreme pressure lubricant tends to decrease as the temperature increases.

3. The load-carrying capacity of an extreme pressure lubricant tends to decrease as the rubbing speed increases.

4. The effects of speed and temperature differ with the particular lubricant and the machine involved to such an extent that even the order of rating may be changed.

5. The ratio of the applied load to the actual pressure changes rapidly on running with each of the four machines.

Since it is desirable to have the ratio of the applied load to the actual pressure remain constant throughout each run, the Bureau of Standards is now developing a machine to achieve this result.

Table 1—Types of Lubricants

No.	Classification
1	Straight Mineral Oil SAE 70
2	Mineral Oil + Lard Oil
3	Commercial Lead Soap Lubricant (Non-Corrosive)
4	Lead Soap Lubricant Free from Sulphur
5	Commercial Sulphurized Lubricant
6	Sulphur Chloride Lubricant (16⅔% base plus 83 ⅓% lubricant No. 1)
7	Sulphur Chloride Lubricant (72% lubricant No. 6 plus 28% lubricant No. 1)
8	Castor Oil, U.S.P.
9	Commercial Lead Soap Lubricant (Corrosive)

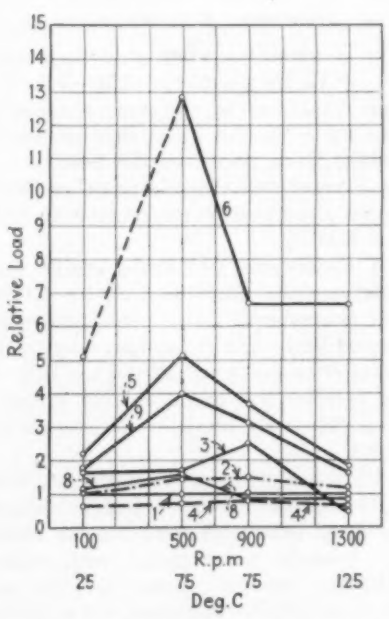


Fig. 1—Relative loads at seizure at various speeds and temperatures for a number of extreme pressure lubricants

Abstract of a paper by S. A. McKee, associate mechanical engineer, E. A. Harrington, research associate, and T. R. McKee, research associate, all of the Bureau of Standards, presented before the annual meeting of the Society of Automotive Engineers, in Detroit, January 23-26.

Per Cent—Of What?

FREDERICK FRANZ

Changes in personal and business affairs are today so numerous, and the apt word "percentage" so readily describes their magnitude, that we again find many cases of indefinite and erroneous uses of that good word.

The true story of the worker who received a 10 per cent increase in wages during the prosperity period and a 10 per cent cut during the following period of depression, only to find that he was then earning less than when he started, is a simple illustration of how the error creeps in. This man earned $1.00 per hour. His 10 per cent increase of 10 cents gave him an earning rate of $1.10 per hour during the prosperity period. When the cuts were made, 10 per cent of his hourly rate ($1.10 per hour) or 11 cents, was deducted from his hourly earnings, leaving only $.99 as his depression rate of pay.

An article that appeared in a financial journal recently, entitled, "A Wage Increase," is another case in point. The erroneous sentence follows, "Plumbers, plasterers, carpenters, painters, and others affiliated with the Indianapolis building trades unions have received a 5 per cent wage increase, which gives them back one-fourth of the 20 per cent cut they took last winter." Let us see whether or not this conclusion is true.

	per hour
Last winter they were earning	$1.00
20 per cent of this, their cut, is	.20
Their earnings in the spring were therefore	.80
5 per cent of this, their present increase, is	.04

This increase is only 4/20 or one-fifth (not one-fourth, as the notice reads) of the 20 per cent cut they took last winter.

The difficulty enters of course in calculating the percentages on different bases. Ten per cent of a large figure cannot be the same as 10 per cent of a small figure.

If we would place the words, "of what?" after each percentage and correctly answer them, we would express ourselves more accurately and would not mislead our hearers or readers.

EDITORIALS

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K. H. CONDIT F. H. COLVIN
EDITORS

Buy Standard

Bargain hunting seems to be in the blood of most humans. It arises probably as much from the feeling of superiority that comes from getting more for our dollar than someone else does as it does from the actual saving of money. Whatever the cause it is a disease that warps our judgment and does much to prevent normal business.

Assuming that we are actually buying quality products at a price below normal, which is not always the case even when a bargain seems to be staring us in the face, let us see just what that does to business in general.

Whether the lower price is because of a reduced wage rate or because of increased efficiency that eliminates part of the working force, the purchasing power of the community has been reduced. The same is true if the manufacturer takes all the loss himself and operates without profit to keep his plant going.

In either case other business suffers. It may be the grocer or butcher, who in turn has to defer the purchase of a new delivery wagon. If the manufacturer takes all the loss he cannot purchase the new machine equipment or the new automobile, or have his house painted as he intended, and even if we assume that the bargain price enables the purchaser to buy more than before, as long as he buys "bargains" on which no one profits, he is not helping business back to a sound basis.

There never was a time when a determination to buy only standard goods at a fair price was more to be desired. It is not altruism but self-protection. A decision to buy only standard products of makers or dealers with an established reputation would do much to stabilize business and prices.

"Buy Standard" is a far safer and saner slogan than those based on geographical boundaries.

Industrial Leadership Needed

Although Technocracy has faded as rapidly as it burst into prominence its emphasis of the complications and dangers in a machine civilization should not be dismissed as visionary.

The machine needs no defense. Without it we should still be in the dark ages. But there is no denying that its introduction has usually brought more than temporary hardship to those it displaced, which, judged by present-day standards of human relations, were unwarranted. On the other hand, we know that its greatly increased productivity has contributed to the shortening of working hours and has made the cost of direct labor a less important factor in industry.

While discounting the dire predictions of the technocrats, such well-known industrialists as Dean Kimball and Gerard Swope advocate a shorter work week and greater security for the worker. This attitude is not only highly desirable as an answer to dismal prophecies, but has a direct bearing on the soundness of investments in the machines themselves. For employment that permits workers to maintain the American standard of living makes and maintains a market for the products of the machines.

Whatever the cause, unemployment is a menace both to the morale of the people and to the stability of all industry. It is not enough to decry theoretical or fantastic causes or remedies for our troubles. Safety lies in intelligent, organized effort that will at least make a beginning at finding a way out of our present troubles. Failure in this effort invites legislation that is apt to be ill-advised, drastic or even confiscatory.

Pricing Policies

Machinery builders will do well to consider carefully the suggestions made by A. P. Haake, secretary of the National Association of Furniture Manufacturers. Briefly, he calls attention to the inevitable increase in the price of raw materials and its effect on present-day quotations. He points out the danger of quoting for future delivery at today's prices and that present inventories need not be sold at a loss. It is better to lose an order than to set a price that may affect the standard of future business.

By limiting present quotations to a short period he feels that we not only show faith in the future but can avoid losses on low-priced orders taken too far in advance.

Wholesale Scrapping

Taking the bull by the horns, the President cleared up an impossible banking situation by scrapping the remaining weak units in the structure. Similar action in other branches of business and industry is inevitable, and signs are multiplying to indicate that the zero hour is at hand in the metal-working industry.

Word has just reached us from a prominent machine tool dealer that one of his customers reports the scrapping of 175 tons of equipment during the last two months. On one of the following pages we are printing an illustration of a yard full of scrapped auto-

matics, an outcome of the transfer of National Acme's Windsor plant to Cleveland.

Wholesale scrapping of equipment is always a painful process but a time comes when it is unavoidable. We believe that that time has come and that the great majority of the plants in the metal-working industry must take such action in order to relieve their financial structures of the burden of obsolete and useless machinery.

• CHIPS •

President Roosevelt issues comprehensive order revolutionizing pension system of U. S. . . . Cuts salaries of government employees fifteen per cent on strength of larger reduction in cost of living index . . . Urges governors of oil states to cooperate in curbing production . . . Cuts tariff rates on certain farm implements under terms of flexible tariff law . . . Enlistment of unemployed in reforestation army commences . . . Senate working on compulsory 30-hour employment bill . . . Governor Lehman of New York urges legislation permitting municipalities to go into public utility business and sell to surrounding territory . . . Resolution to prohibit erection of factory-built steel houses introduced in Chicago city council . . . Hoarders warned of prison terms after May 1.

Dirigible Akron forced down at sea in line squall . . . crushed on impact with water . . . 73 lost including Admiral Moffett and Commander McCord . . . Rescuing blimp also falls with loss of two men . . . British aviators fly two planes over Mt. Everest . . . U. S. Lines to drop Leviathan and replace her by 30,000-ton cabin ship . . . W. F. Gibbs retained on design . . . Steel for Pacific Coast now being shipped from Pittsburgh by barge to Gulf, thence by ship through Canal . . . inflexible rail rates responsible . . . Canadian National and Canadian Pacific pool limited trains to save expense . . . Wabash consolidates Chicago-Detroit service with Pennsylvania . . . drops Detroit-Buffalo runs . . . Passenger service between Chicago and St. Louis being pooled . . . Reading and Pennsylvania file brief with I.C.C. for consolidation of Atlantic City services.

Beer is back . . . and a considerable amount of uncertainty with it as some states fail to get regulations in force . . . Ban on medicinal liquor raised by Congress . . . Michigan votes wet on repeal . . . Wisconsin votes wetter, no county voting dry . . . Employment in breweries increases and suppliers of materials and equipment profit . . . Politicians struggle for lucrative patronage in beer licensing control.

MacDonald to sail for Roosevelt parley by April 15 . . . Britain prepares to wield import embargo club against Russia in Metro-Vic espionage case . . . Soviet traders, annoyed by tactics of German Nazis, astonished at British attitude, hampered by lack of income, talk of placing contracts here and in other countries where the way is clear . . . Mussolini approves plan for Italian Technical Council under leadership of Marconi . . . Japan demands Chinese withdrawal behind Great Wall . . . increases purchases of lead in U. S. . . . Hitler's campaign against the Jews stirs world-wide resentment . . . stops refugees at border . . . Hindenburg forced to remind him of his oath to constitution . . . Ends open boycott but continues indirect one by placarding German shops . . . German foreign trade and security prices suffer.

Union and Guardian Trusts of Cleveland to unite with R.F.C. backing . . . Receivers appointed for holding groups of big Detroit closed banks . . . Deposits rise in new First National of Detroit . . . Chase National moves to separate securities selling unit . . . New head of Bank of International Settlements predicts early return of nineteen nations to gold standard . . . International Harvester of Canada arranges to barter farm implements for wheat on 75-cent-a-bushel basis . . . Other coal regions start to organize distributing companies following lead of Appalachian Coals . . . Naval project including twenty destroyers, four submarines, one aircraft carrier, one light cruiser, and one flying-deck cruiser put forward by Secretary Swanson and Representative Vinson of Naval Affairs Committee . . . would provide work for thousands of skilled men and would be a step toward treaty parity.

Missouri Pacific files bankruptcy petition under new law . . . present administrative officers to continue operations . . . Goodrich announces 40 per cent increase in production rate . . . General Tire and Rubber now on a six-day basis . . . Labor leaders agree with Secretary Perkins on emergency relief measures . . . Westinghouse recalls furloughed to start work on 240-ton steel gates for Hoover Dam . . . Gillette loses razor blade infringement case . . . Additional orders raise operating schedule at Dunkirk U. S. Radiator plant from two to four days a week.

Electric power output rises to within 5.3 per cent of last year's figure . . . Railroad shippers estimate second quarter loadings almost up to 1932 . . . Steel ingot production up 1½ per cent . . . Automobile and brewery business grows . . . *Iron Age* composite pig iron price makes first rise since May, 1929 . . . Plans to reduce output of non-ferrous metals progress . . . Prices steady or higher.

Management Association Confers on Production

Two production conferences will be held on consecutive days by the American Management Association. The job Order Production conference, under the direction of O. D. REICH, vice-president and works manager, Dexter Folder Co., will meet in Cleveland on April 13. The Mass Production Conference, directed by C. S. CRAIGMILE, general superintendent, Belden Manufacturing Co., will meet in the same city on April 14. The programs and papers to be present are as follows:

APRIL 13

Job Order Production Conference

Morning Session

P. L. DILDINE, manager factory standards, B. F. Goodrich Co., presiding.

"Product Design and Its Influence on Set-Up Time," by WALTER DORWIN TEAGUE, industrial engineer, and TELL BERNA, general sales manager, National Acme Co.

"Effect of Proper Selection of Machines and Equipment on Set-Up Time," by A. J. BRANDT, A. J. Brandt, Inc., and S. H. FISHER, works manager, American Hard Rubber Co.

Afternoon Session

RAYMOND S. PERRY, vice-president, Ingersoll Milling Machine Co., presiding.

"What the Foreman Can Contribute in Reducing Set-Up Time" by GLENN GARDINER, assistant to president, Forstmann Woolen Co. and D. N. Ives, factory manager, Ritter Dental Mfg. Co.

"Use of Time and Motion Study in Reducing Set-Up Time" by ALLAN H. MOGENSEN, industrial consultant, consulting editor, *Factory Management and Maintenance*, and A. B. SEGUR, A. B. Segur & Co.

Dinner Meeting

APRIL 14

Mass Production Conference

Morning Session

C. S. CRAIGMILE, presiding.

"Analyzing Purchasing Policies in Speeding Up Inventory Turnover" by R. M. BOWMAN, purchasing agent, Republic Steel Corporation and H. H. KRAUSE, purchasing agent, National Screw & Mfg. Co.

"Production Methods to Speed Up Turnover" by DR. WALTER RAUTENSTRAUCH, professor of industrial engineering, Columbia University, C. S. CARNEY, vice-president, Trundle Engineering Co., and E. S. AULT, associate professor of machine design, Case School of Applied Science.

Afternoon Session

OSCAR GROTHE, works manager, White Sewing Machine Corp., presiding.

"There Isn't Any Bottom to Costs," by CHAPIN HOSKINS, managing editor, *Forbes*.

"Case Studies on Reducing Prices While Retaining or Improving Quality" by JOHN PAUL JONES, industrial engineering department, Standard Oil Co. (Indiana), C. S. CRAIGMILE and H. I. LEWIS, manager, Seybold Machine Co. Division, Harrison-Seybold-Potter Co.

Gear Makers Meet in May

May 4, 5 and 6 have been set for the annual meeting of the American Gear Manufacturers Association to be held at Wilkinsburg, Pa. The annual dinner will take place on the evening of Friday, May 5.

Among the interesting addresses arranged by B. F. WATERMAN, chairman of the meetings committee, are the following:

"Bullard-Dunn Process for Descaling Metals as Applied to the Cleaning of Heat-Treated Gears," by F. T. TAYLOR, The Bullard Co.

"Heat-Treatment of Transmission Gears," by E. F. DAVIS, metallurgist, Warren Gear Co.

"Welded Gears," by EVERETT CHAPMAN, director of research and engineering, Lukenweld, Inc.

"Lapping of Gear Teeth," ROBERT S. DRUMMOND, president, National Broach & Machine Co.

"Combination Motor and Reducer Units," by RICHARD S. MARTHENS, manager gear engineering department, Westinghouse Electric & Mfg. Co.

A. A. Ross, chairman of the general standardization committee, has arranged for complete reports from eleven active committees embracing research, bevel and spiral bevel gears, herringbone gears, inspection, keyway, metallurgical, sprocket, spur gear, tooth form, nonmetallic, and railway, mill and mining.

E. S. SAWTELLE, chairman of the commercial standards committee, has a unique program touching on sales and service which includes two one-act plays, "A Sales Lesson" and "What Was Left Out."

New Date Set for Case Conference

Postponed because of the banking holiday, the conference on "Re-Engineering for Economical Manufacture," sponsored by the Case School of Applied Service and originally planned for March 22-24, will be held at Cleveland on May 10-12. The program will closely conform to that previously announced (*AM*—Vol. 77, page 148e).

Industrial Engineers to Meet at Chicago

During Engineering Week, when sixteen national engineering societies will meet at Chicago, the Society of Industrial Engineers will open its convention

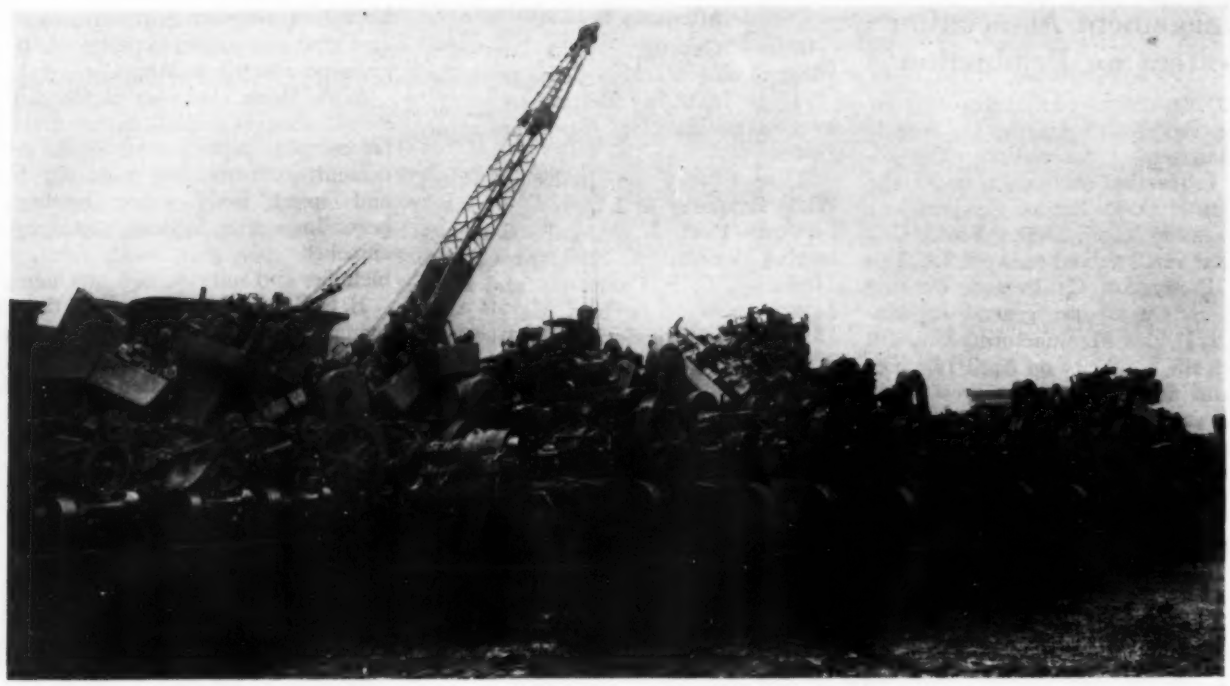
• INDUSTRIAL REVIEW •

No orders of any consequence have been received in the machinery trade. Even the brewers have concluded to go slowly until they are sure that 3.2 beer is going to be popular. Leaders in the machinery industry are hopeful that the Roosevelt program will include measures that will provide employment for their employees. The proposed naval building program would be helpful and authorization of educational munition order placements would be more so. The Black 30-hour work bill has caused considerable concern.

At least one bonafide order traceable to beer is reported from New York. A bottle filling machine builder got swamped and had to buy a machine tool quickly. Boston feels more optimistic but has no orders to strengthen this sentiment. Philadelphia is similarly situated. A large metal-working plant in the Pittsburgh district has scrapped 175 tons of equipment in the last 60 days. It was scraped because the second-hand market was glutted. Inquiries are better.

In Cleveland the banking situation is beginning to clear up but there is some difficulty over wage rates. Although most employers are keeping rates up a few are offering starvation wages and getting men because of their desperate need. Detroit seems to be marking time until the banking situation improves, but here and there an inquiry appears and there is undoubtedly more activity and hope among the automobile people.

Several machine tool orders traceable to beer were placed in Chicago and the general feeling is that things are looking better. Agricultural implement plants are quiet. Business in Cincinnati is as quiet as ever. In St. Louis business is still marking time although a few shops that cater to the brewing industry have been busy. Milwaukee feels that business is on the upgrade but is not reporting any orders.



Ready for the Skull Cracker

Hundreds of National Acme automatics, rendered entirely obsolete by recent developments, are to be broken for scrap. This action is part of the company's renovation program which is being effected concurrently with the concentration of all manufacturing activities at Cleveland, and the closing of its Windsor, Vt., plant. National Acme's automatic screw machine products division will be materially curtailed in accordance with the policy of the past few years of minimizing competition with its own customers in this field

on June 27 with an educational conference to discuss "The Professional Engineer's Attitude Toward the Curriculum and Graduate in Industrial Engineering." Other subjects to be discussed are:

Recent Social Changes and Their Effect on Economic Life.

What Have We Learned of the Art of Management.

The Engineer's Part in Economic Stabilization.

A Report of an S.I.E. committee studying industrial, economic, and social conditions.

Unemployment Insurance.

Consumers' Acceptance the Hub of Merchandising Plans.

Curtailing Sales Expense on Capital Investment Equipment.

Use of Micromotion Studies to Reduce Production Costs and Fatigue.

International Congress To Be Held by S.A.E.

Concurrently with the Century of Progress exposition, the International Air Meet, the Gordon Bennett Trophy race and other events of wide interest, the International Automotive Engineering Congress will be sponsored by the Society of Automotive Engineers in Chicago, August 28 to September 4.

Outstanding engineers and executives of the automotive and allied industries will take part in authoritative discussions on technical topics and features of general interest. Included among these subjects will be the design, production, operation and maintenance of passenger cars, passenger car bodies, aircraft, aircraft engines, diesel engines, motor trucks and coaches, as well as the internal combustion engine side of the tractor and marine industries, and the various phases of automotive fuels and lubricants.

ALEX TAUB of Detroit is chairman of the meetings committee in charge of staging this congress.

German Trade on Sound Basis Despite Disturbances

Despite the dislocation of German business and the fall of German security prices directly traceable to political disturbances resulting from the Hitler dictatorship, the country intrinsically is in a better trade position than it was a year ago. Prior to the drastic measures employed by the Brown Shirts, the decline of business had stopped, production and trade had begun to increase after years of decline, and the financial crisis had been overcome. It may well be that if Hitler and his advisors revise their program with an eye to the influence of international psychology, the improved basic condition of German business may again make itself felt in a resumption of this upward trend.

According to a study made by the National Industrial Conference Board, "The Situation in Germany at the Beginning of 1933," Germany in 1932 had a sufficient supply of foreign exchange to pay interest and amortization charges on her short-term and long-term foreign debt and to reduce her short-term indebtedness by approximately $180,000,000.

Without the burden of reparation payments Germany may be regarded as a solvent and going concern. A total foreign debt of less than $4,000,000,000 cannot be regarded as excessive for a country of the size and economic strength of Germany. The problem of short-term credits, which loomed so large in the first Basle committee report, no longer appears so serious. The great decline in the surplus of commodity exports during the first two months of 1933, however, is an unfavorable development. The export surplus declined from $47,600,000 to $11,900,000. A revival of international trade is of extreme importance to Germany and to Germany's creditors.

It seems reasonable to expect that the foreign creditors will continue to cooperate with the German government and German financial institutions with a view to enabling Germany to strengthen her financial position. It should be clearly understood that economic recovery in Europe cannot take place so long as Germany remains in a precarious position. This fact was recognized by the creditor governments at the Lausanne Conference and has received equal recognition from Germany's private creditors. Finally, a grave responsibility rests on the shoulders of political leaders of Germany to safeguard the interest of Germany's creditors by practising moderation in domestic politics and by cultivating friendly relations with foreign countries.

German Balance of International Payments in 1932

Millions of Dollars

Credits:	
Surplus of commodity exports	255
Interest in German investments abroad	71
Net income from service	76
Sales of foreign exchange by German nationals	24
Total credits	426
Debits:	
Interest on long-term debt	124
Amortization of long-term debt	31
Interest on short-term credits	114
German-Belgian mark agreement	5
Repayments	182
Total debits	456

• BUSINESS ITEMS •

Consolidation of its entire business under one roof has been effected by the Smith Booth Usher Co., dealers in metal working machinery as well as many other lines of machinery, at 2001 Santa Fe Ave., Los Angeles, Cal. The new plant will house the general offices, salesrooms, parts and service, and warehouse for the following departments—pumps, engines, compressors, machine tools, woodworking machinery, construction equipment, pipe, valves and fittings, and will thus enable better service to be rendered.

Taylor & Co., Inc., Norristown, Pa., will commence manufacturing operations on vulcanized fiber, phenol fiber and noiseless gears at its modern plant during the early part of May. The executive organization and the operating personnel are composed of persons formerly associated with the Diamond State Fibre Co. and its subsidiary, the Celoron Co. Officers are as follows: J. M. Taylor, president; L. T. McCloskey, sales manager, formerly vice-president of the Continental-Diamond Fibre Co., and C. N. Jacobs, plant manager.

To eliminate duplicated activities, the C. Newman Wire Co., Inc., New York, and the J. D. Crosby Co., manufacturing affiliate, have consolidated, and the new company will be known as the Newman - Crosby Steel Corp. The Crosby Co. produces cold-rolled strip at Pawtucket, R. I.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., has organized a steel castings division and will specialize in the making of all kinds of commercial steel castings of carbon chrome, nickel chrome, tungsten and special alloy steels. J. L. Blackledge, formerly connected with the Lebanon Steel Foundry, Lebanon, Pa., will act as manager.

The obsolete Deering Works at Chicago will be abandoned by the International Harvester Co., and operations will be concentrated in the more modern McCormick works, which is better adapted to the manufacture of large equipment.

Harnischfeger Corp., Milwaukee, Wis., has appointed Floradin Equipment Co., 40 West 40th St., New York, N. Y., as its representative for welding equipment in the metropolitan district of New York and northern New Jersey.

American Measurement Standards Service, Box 1127, Washington, D. C., has been set up by William E. Bullock and Samuel Russell for the purpose of rendering expert information and analysis of departmental projects and legislative activities in the field of measurement units and standards, measuring apparatus and devices, regulations prescribing tolerances and allowances, and trend of measurement standards legislation.

• PERSONALS •

F. H. Chapin, president of the National Acme Co., Cleveland, Ohio, has been elected chairman of the board, in addition to his present duties, succeeding A. W. Henn, who remains a director.

William H. McClelland has resigned as sales manager of the machinery department of the Strong, Carlisle & Hammond Co., with which he was connected for 26 years. George J. Zimmerman has succeeded Mr. McClelland and has been appointed manager of the Cleveland machine tool department in addition to the management of the Detroit branch.

Clark T. Morse, formerly vice-president, has been elected president of the American Blower Corp., Detroit, succeeding James Inglis, who became chairman of the board. The firm is a subsidiary of the American Radiator & Standard Sanitary Corp.

Henry K. Smith has been re-elected president of the Marlin-Rockwell Corp., Jamestown, N. Y. Other officers were re-elected at the annual meeting, March 21.

Abram C. Mott, Jr., has been elected president and treasurer of the Abram Cox Manufacturing Corp., Lansdale, Pa., a new concern recently formed to take over the assets and equipment of the Abram Cox Co., Philadelphia, maker of cast-iron heating boilers, tank heaters and furnaces.

Oscar E. Anderson has been elected vice-president and general manager of the Dahlstrom Metallic Door Co., Jamestown, N. Y. As vice-president he succeeds Carl Olofson, and as general

manager he succeeds H. E. V. PORTER, president, who has acted also as general manager during the past year. ELMER W. SELLSTROM, plant superintendent, has been elected assistant general manager.

H. D. NORTH, vice-president of the Ferry Cap & Set Screw Co., has succeeded as president the late THOMAS FERRY. E. W. FERRY, son of the founder, was elected vice-president and secretary.

ROY C. MUIR has been appointed manager of the engineering department, General Electric Co., Schenectady.

• OBITUARIES •

Eveleth, General Electric Vice-President, Dies

CHARLES EDWARD EVELETH, 57, vice-president of the General Electric Co., died at Schenectady, March 25. Mr. Eveleth was associated with E. W. ALLEN, vice-president, in the engineering department and had charge of the designing engineering departments and of the works laboratories attached to each major manufacturing plant. When made a vice-president in 1927, Mr. Eveleth was at first associated with C. C. CHESNEY and W. R. BURROWS in the management of the manufacturing department. In September, 1922, he was appointed assistant manager of the Schenectady works and on Jan. 1, 1923, was made works manager, which position he held until he became a vice-president in 1927.

Prominent Publisher Passes

ANDREW CAMERON PEARSON, chairman of the board of the United Publishers Corp., New York, publishers of *Iron Age* and *Hardware Age* and other magazines, died March 31 at the age of 59. Mr. Pearson was chairman of that corporation since 1926. In 1898 he joined the advertising staff of the *Dry Goods Reporter* in Chicago, from which he was transferred to the *Dry Goods Economist* in New York in 1904. In 1924 he became president of the Economist Group Publications. In 1913 he was made secretary of the United Publishers Corp., where he rose to his last position in 1926. Mr. Pearson was president of the National Publishers Association, national chairman of the American Publishers Conference, and a director of the Chamber of Commerce of the United States, 1922-24.

C. E. EVELETH

A. C. PEARSON

LT. COL. ALFRED F. MASURY, 50, lost on the *Akron*, was vice-president, chief engineer and a director of the International Motor Truck Co. Col. Masury was chairman of the Ordnance Advisory Committee of the S. A. E. and a colonel in the Ordnance Reserve Corps. He was an authority on internal combustion engines.

FREDERICK W. PARSONS, vice-president of the Ingersoll-Rand Co., and manager of the company's plants at Painted Post, N. Y., and Athens, Pa., died April 1 at the age of 67. Mr. Parsons was at one time manager of the plants at Ossining and Tarrytown, N. Y.

GEN. COLDEN L'HOMMEDIEU RUGGLES, retired, chief of the inspection division of the Ordnance Department in the World War, died April 2 at the age of 64. Gen. Ruggles served at several arsenals and at Sandy Hook Proving Ground and was professor of ordnance and gunnery at West Point. He was appointed chief of the inspection division of the Ordnance Department in 1918 and served after the war as chief of the technical staff.

NORMAN F. THOMPSON, JR., president of the Gilbert Clock Co., Winsted, Conn., died April 2 at the age of 49. Mr. Thompson worked in the Burson plant at Rockford and rose to be head of the concern. He was a former president of the Clock Manufacturers Association of America.

PROF. W. C. UNWIN, 94, author of "Elements of Machine Design," well-known to American engineers as a standard text book, died in England on March 17. In 1915 and 1916 Prof. Unwin was president of the Institution of Mechanical Engineers. He was at one time connected with the commission that investigated the use of the Niagara Falls for power generation purposes.

• MEETINGS •

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, May 4-6. Penn Lincoln Hotel, Wilkinsburg, Pa. J. S. MCQUISTON, managing secretary, First National Bank Bldg., Wilkinsburg, Pa.

AMERICAN MANAGEMENT ASSOCIATION. Division meetings—job order production and mass production. April 13-14 Hotel Statler, Cleveland, Ohio. K. B. ANDERSEN, secretary, 20 Vesey St., New York, N. Y.

AMERICAN SUPPLY & MACHINERY MANUFACTURERS ASSOCIATION. Annual meeting. May 8-11. Louisville, Ky. R. KENNEDY HANSON, secretary-manager, Clark Bldg., Pittsburgh, Pa.

AMERICAN WELDING SOCIETY. Annual meeting. April 27-28. New York, N. Y. MISS M. M. KELLY, secretary, 29 West 39th St., New York, N. Y.

CASE SCHOOL OF APPLIED SCIENCE AND THE CLEVELAND ENGINEERING SOCIETY. Joint conference on "Re-Engineering for Economical Manufacture." May 10-12. Case School of Applied Science, Cleveland, Ohio. PROF. E. S. AULT, chairman.

MIDWEST ENGINEERING & POWER EXPOSITION. June 25-30. Coliseum, Chicago. Headquarters, 308 West Washington St., Chicago, Ill.

NATIONAL FOREIGN TRADE COUNCIL. Twentieth national foreign trade convention. April 26-28. Hotel William Penn., Pittsburgh, Pa. GARDNER L. HARDING, secretary, India House, Hanover Square, New York, N. Y.

THE ROUND TABLE

Production Control

"Hello, Ed, glad to see you. How's the old appetite today?"

"Howdy, Al, same to you. How's business?"

"Fine, almost too much so. Most of the conditional orders have been released, and some of the customers seem to feel aggrieved that we didn't build their compressors on their conditional order and have them waiting for them."

"What was that line of talk you used to give me down at the old shop? The customer is always unreasonable? No, that wasn't it—the customer is always right. How does that work out from the boss's point of view?"

"Not so good, Ed, I have to have a placard with that motto on over my desk to remind me of it. But I can say this: The boss stands the brunt of the customers' fussiness. He doesn't pass it on to the foreman."

"Well, if he doesn't, it's about the only thing that isn't passed along."

"Even so, Ed, a foreman's life is a happy one compared to that of the owner of a small shop; he makes more money and doesn't work so hard. After I have lunch I've got to work out a schedule that will satisfy our insistent customers and put into effect some sort of a production control system."

"Yeah, and when I finish my lunch I've got to rivet another tail on our cat. She needs it about as much as you need a production control system."

"What makes you think we don't need a control system?"

"Why, it's plain enough. You manufacture one single article and you've only got two, or is it three, men. The place will run itself if you'll only let it."

"Yes, it will—not. You're like the people who think that shops ought to get out a rush order quicker when there is no work in the shop. As you say, I've got three or four men to spread over a hundred operations, and I've got to do those operations in a sequence that will waste the least time, and bring the different parts through in different sized lots that will be most economical of time and material. To do that, I sure need something more than a wish and a hope."

"When I was serving my time, I worked in a shop with about fifty men, and we made about everything you can think of that's made from castings and forgings. The owner ran the shop himself and carried his orders in his head. I can't remember ever having to wait for a job, and I don't remember any customer kicking because his machine wasn't finished on time."

"You only believe that, Ed, because at the time there was no such thing as manufacturing and no such thing as material control. About every cent the owner had was tied up in the material that cluttered up the shop. The owner knew nothing of material turnover, and the customer regarded any delay on his work as an act of God—something to accept without question or complaint. I'll bet you never worked overtime in those days. When six o'clock came the shop shut down, and to have a night force would have been flying in the face of nature. Times have changed and men have changed with them. Our compressors are seldom used as an independent unit, they are important links in a sequential process. The customer will not accept excuses for broken promises, and I don't propose to spend my time working up alibis."

"It's easier to placate an impatient customer than it is to placate a banker when you can't pay your note. I don't know, and don't want to know, what profit you are making on your compressor, but I do know that four men can't carry more than you and Mason as overhead, and pay much of a dividend. And it's the dividend I'm interested in."

"Me too, Ed. Before you and Williams came in, I didn't think much about dividends. I had my drawing account, and it took care of my necessities. Now you and Williams are a powerful incentive to earning a dividend; I begin to see the importance of having stockholders."

"Well, I hope the incentive persists. So long, Al."

Is production control necessary in a small shop where only a single type of apparatus is made? Should Al start out with a production system or wait until its necessity is apparent?

Discussion

Renovizing

Al would be much wiser if he bought tools and equipment with the money intended for renovating. It is an erroneous policy to ignore equipment for other petty improvements as has been the case with a few firms that I have observed. The management of the plants in discussion sadly neglected appropriations for the purchase of newer and better equipment to keep in pace with the trend of time. When business dropped off, they were hit much more severely because of inability successfully to contend with better equipped shops.

I am not in favor of a slopping-look-

ing shop, but equipment is of primary importance in my consideration; let the "dolling up" come next. Because the interior of the shop needs a little painting, that does not mean that it cannot be kept clean. Certain conditions and complications arise in manufacturing that can only be logically solved by obtaining new equipment; therefore, it is best to set aside any extra funds for that purpose. When moving into new quarters, it is best to get settled as soon as possible, and get started on production. —PETER L. BUDWITZ.

Larger Quarters

It looks as though Al and Mason are going to follow the same course that has landed so many businesses, both large and small, in financial difficulties. That is, going into debt in expanding their plant and having only unproven prospects of a larger sales volume. Regardless of size or product, no business should go into debt to expand until the possibilities of a double shift have been thoroughly exhausted. Even then expansion may not be justified by the probable volume of sales.

Al says, "Mason and I have been lucky. We have made some money . . . . . and feel sure that we can sell all the compressors we can produce with the machinery we can afford to buy." In all probability they have been lucky to have made money. It has required a good product and the determined application of their combined skill and common sense to do it on their limited capital. There are admittedly good prospects for sales in their chosen field. But so far as they are concerned these sales have not yet been made in any great amount. They do not have a large volume of sure orders on their books nor do they know positively that they ever will have them.

When a business radically enlarges the plant, overhead charges multiply and have a surprising tendency to leap out of hiding in many unthought of places. This is especially true when the business is unable to pay its own cash for the improved plant but must borrow all or a part of the money for this purpose.

It is far better to have to refuse orders than to overenlarge capacity on a shaky financial foundation.

—L. O. BROWN.

An accurately kept cost account is the only authority that can truly answer the questions that present themselves in regard to moving into larger quarters at the present time. The partners have done part of their work themselves and have jobbed out orders that were in excess of their capacity. Therefore their books should indicate the difference in cost. If the profits on jobbed out work are sufficient to warrant its continuance for a time, they would do well to abandon the idea of plunging themselves into debt for the purpose of renting an old building.

In the face of present conditions it seems reasonable that a good contract shop, which can guarantee both delivery and quality, would be available. This would give Al and Mason an opportunity to build up a cash reserve. It would give them time to consider the purchase for cash of acreage along the railroad tracks well outside the limits of the town. They could do a lot of unhurried planning and in general make the step into larger quarters one of natural and orderly development rather than a sudden jump into a condition of doubtful value. —HENRY SCHOLS.

High Finance

A firm having a book value of ten thousand dollars shows good business management by incorporating for twenty thousand dollars. The two original partners show good faith in keeping five thousand dollars of the new stock, and this set-up under ordinary management would be a wise investment for our friend Ed, assuming of course

that he believes that the two members are good mechanics and well versed in the article they are manufacturing.

The partners make a grave mistake and burden the corporation with an obligation that may prove embarrassing by promising to buy back the stock. Their main object in issuing common stock is to raise working capital without obligating the corporation to purchase it back. It would be much better to issue bonds since the corporation would know in advance when it would be required to redeem them.

—C. STAPLES.

"What's in a Name?"

A company name, in order to have real advertising value, must have behind it a certain reputation for putting out a quality product. If we delve into the past history of any great manufacturing company we usually find that at its humble beginning, the company name was only a mark of identification which really signified nothing. Only when that company's product began to take hold and build a reputation did the name begin to have advertising value.

So Al need lose no sleep in worrying over the firm's name. If Mason and Morton are building a good compressor and keep on doing so, their fame will travel wherever compressors are used. Also, the glory will reflect on any other product they decide to manufacture.

—ROBERT S. ALEXANDER.

Another New Model

During the last five or six years the ultimate goal of all manufacturers has been to place their product in such a unique position as regards sales advantage that distribution becomes an art rather than a vital struggle for existence. This ideal situation may be obtained from two general sources. First, protection by patents of considerable scope; second, design features that are in advance of current standards.

Irrespective of present industrial conditions, every manufacturing enterprise of any consequence constantly employs a staff of engineers whose efforts are expended in three major directions: first, reduction of manufacturing costs of present models; second, intensive development to the end that sales resistance be reduced to a minimum; third, complete investigation in the field of pure research for results that can be used as a basis for future attainments. Each manufacturer is striving to isolate himself from competition and thereby become a leader in his field.

Assuming a sound policy of development, the next problem is the possible reaction of the user toward radical departures from existing standards. To my way of thinking, the process is just a question of salesmanship and education. For example, the automobile industry has for years fostered the idea of yearly models. The public has now taken for granted that yearly models will be forthcoming. The same thing applies to all manufactured products; it is just a matter of establishing a precedent. The lapse of time between different models is generally formulated by conditions within the industry. Before any attempt is made to advance a new product, its possibilities must be firmly and definitely substantiated through careful analytical research. Until this requirement is fulfilled no announcement should be made. Once the new product is in production, all unsold machines should be reduced in price to a point where they can be disposed of before the new model is available.

HAROLD L. WYNN, *Executive Engineer, Pacific Electric Mfg. Corporation.*

American Machinist
REFERENCE BOOK SHEET

Tap Drill Sizes—II

American National Coarse Thread Series

Size of Screw	Threads per Inch	Nominal sizes of stock drills for per cent of full thread						
		50 to 60 Per cent	60 to 65 Per Cent	65 to 70 Per Cent	70 to 75 Per Cent	75 to 80 Per Cent	80 to 85 Per Cent	85 to 100 Per Cent
1	64	1/16	.....	53*	.....	.....	.....	54
2	56	49	1.8 mm*	50*	1.75 mm*	.....	51*	52
3	48	.....	45*	46*	2 mm*	47—3/64*	48	49
4	40	3/32—42	.....	2.3 mm*	43*	2.2 mm*	44	45—46
5	40	36	37*	2.6 mm*	38*	39*	40*	41—3/32—42
6	32	32	33	34*—35*	7/64*	36*	37	38—39—40
8	32	9/64—28	3.5 mm*	29*	3.4mm*	.....	3.3 mm	30—1/8
10	24	20—21	22—5/32	23*	24*—25*	26*	27	9/64—28—29
12	24	5/16—13	14	15*	16*	17*	13/64*	18—19
1/4	20	3	4	5*	6*—13/64*	7*—8*	9*	10—11—12—3/16—13
5/16	18	I	H	17/64	G*	F*	6.4 mm	1/4—E—D—C
3/8	16	Q—21/64	P	8.1 mm	O*	5/16*	7.8 mm	N—19/64—M
7/16	14	25/64—W	9.6 mm	V—3/8	U*	9.3*—9.25 mm*	23/64	T—S
1/2	13	.....	3/16	11 mm	.....	29/64*	.....	Z—13/32—Y
9/16	12	1/2	.....	12.5 mm	33/64*	.....	12 mm*	15/32
5/8	11	9/16	14 mm	35/64	.....	17/32*	.....	33/64
3/4	10	.....	43/64	.....	21/32	16.5 mm*	41/64	5/8
7/8	9	51/64	20 mm	29/32	19.5 mm*	49/64*	.....	3/4—47/64
1	8	29/32	.....	57/64	22.5 mm	7/8*	22 mm*	55/64—27/32
1 1/8	7	1 3/32—1 1/64	.....	1	.....	63/64*	31/32	63/64
1 1/4	7	1 9/32—1 5/64	.....	1 1/16	.....	1 7/64*	1 1/32	1 1/64
1 3/8	6	1 17/64—1 1/4	1 5/64	.....	1 3/32	1 11/64*	30.5 mm*	1 1/64—1 1/64
1 1/2	6	1 25/64—1 3/8	1 33/64	34.5 mm	1 1/32	1 27/64*	33.5 mm	1 1/64—1 9/64
1 3/4	5	1 39/64	1 13/32	1 27/64	1 9/16	1 35/64*	1 17/32	1 33/64—1 1/2
2	4 1/2	1 27/32—1 53/64	1 1 3/16	46 mm	1 1/64	1 25/32*	1 49/64*	1 3/4—1 47/64—1 23/32
2 1/4	4 1/2	2 1/32—2 5/64	2 1/16	.....	2 1/64	2 1/32*	2 1/64	2—1 1/64—1 1/32
2 1/2	4	2 13/64—2 1/16	2 1/64	2 1/32	2 1/32	2 1/64*	2 1/64*	2 7/32—2 1/64—2 1/16
2 3/4	4	2 37/64—2 9/16	2 1/64	2 17/32	2 1/64	2 1/32*	2 1/64*	2 1/32—2 9/64—2 1/16
3	4	2 53/64—2 13/16	2 1/64	2 1/32	2 1/64	2 1/64*	2 7/64*	2 1/32—2 5/64—2 1/16
3	3 1/2	2 13/16—2 13/64—2 25/32	2 1/64	2 1/64	2 7/64	2 3/32*—2 1/64*	2 1/16	2 1/64—2 1/32—2 1/64
3 1/4	3 1/2	3 1/16—3 1/32	.....	3	2 1/64	2 3/32*—2 1/64*	2 1/16	2 9/64—2 1/32—2 7/64
3 3/4	3	3 1/32	.....	.....	3 1/16	.....	.....	3 3/64—3 1/32
4	3	.....	.....	.....	.....	.....	.....	.....

*Drill sizes are within standard limits for minor diameter of nuts.
Metric sizes are included only where numbered or fractional-inch sizes corresponding to the precentage range at top of column are not available.

Contributed by D. R. Miller, chief, and I. H. Fullmer, assistant chief of the Gage Section, National Screw Thread Commission Bureau of Standards.

Continued on next page

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American Machinist
REFERENCE BOOK SHEET

Tap Drill Sizes—II

American National Fine Thread Series

Size of Screw	Threads per Inch	Nominal sizes of stock drills for per cent of full thread						
		50 to 60 Per cent	60 to 65 Per Cent	65 to 70 Per Cent	70 to 75 Per Cent	75 to 80 Per Cent	80 to 85 Per Cent	85 to 100 Per Cent
0	80	1.3 mm	.....	1.25 mm*	.....	1.2 mm*	3/64*—56	.....
1	72	52—1/16	.....	.....	53	1.5 mm*	.....	54
2	64	1.9 mm	49	.....	1.8 mm*	50*	1.75 mm	51
3	56	44	.....	.....	45*	46*	.....	47—3/64—48
4	48	40—41	2.4 mm	3/32—42*	.....	2.3 mm*	43	44
5	44	35—7/64	36	.....	37*	38*	.....	39—40—41
6	40	31	3 mm	32	2.9 mm*	33*	34*	35—7/64—36
8	36	27	9/64	28	3.5 mm*	29	3.4 mm*	30
10	32	18—19	4.2 mm	.....	20*	21*	22—5/32*	23—24—25
12	28	11—12	3/16	13	14*	15*	16*	17—11/64
1/4	28	5.75 mm—5.7 mm	2	7/32	5.5 mm*	3*	5.4 mm*	4—5—6
5/16	24	9/32—K	7.1 mm	J	I*	6.9 mm*	6.8 mm*	H—17/64—G
3/8	24	11/32	8.7 mm	R	8.5 mm*	Q*	8.4 mm*	21/64—P
7/16	20	Y	X	10 mm	25/64*	W*	9.75 mm	V—3/8
1/2	20	.....	.....	.....	29/64*	.....	.....	7/16
9/16	18	.....	.....	33/64	13 mm	.5062 in.*	.....	1/2
5/8	18	.....	.....	37/64 *	14.5 mm*	.....	.....	9/16
3/4	16	45/64	.....	.....	.....	13/16*	.....	43/64
7/8	14	53/64	.....	13/16	20.5 mm	.....	51/64	20 mm
1	14	61/64	.....	15/16	.....	.....	59/64	.....
1 1/8	12	1 1/16	.....	.....	1 3/64	26.5 mm*	.....	1 1/32
1 1/4	12	1 3/16	30 mm	.....	1 11/64	.....	29.5 mm*	1 5/32
1 3/8	12	1 5/16	.....	33 mm	1 19/64	.....	.....	1 9/32
1 1/2	12	1 7/16	.....	.....	1 27/64	36 mm*	.....	1 13/32

*Drill sizes are within standard limits for minor diameter of nuts.
Metric sizes are included only where numbered or fractional-inch sizes corresponding to the percentage range at top of column are not available.

Ed. Note: The Reference Book Sheet "Tap Drill Sizes" (*AM*-Vol. 76, p. 909) has been criticized by Messrs. Miller and Fullmer on several counts, chief of which are: (1) Machine screws Nos. 7, 9 and above No. 12 are not now standard: (2) Decimal diameters of the screw sizes do not agree with the report of the National Screw Thread Commission or the standard promulgated by the American Standards Association; (3) Drill sizes listed under "Size or Number of Drill for Per Cent of Full Thread" are inconsistent. To remedy these defects the authors worked out tables for coarse and fine series threads in agreement with the American Standard, and these tables are published herewith.

The original Reference Book Sheet represents many years of experience of a shop man who prefers to remain anonymous. His contribution has paved the way to reference material more in line with present practice. But there are still elements of his work that should be considered. For example, the fourth and fifth columns labeled "Body Drill," and "Body Drill for Interchangeable Manufacture" for a given size of screw are results of his shop experience and are worth study. It may well be that some will wish to experiment or to interpolate sizes of "body" drills for use in conjunction with the more recent tables. By "body" drill is meant the size that will drill a hole large enough to permit a given screw to be pushed through so that it can be screwed into a second piece.

The first author also gave the desirable percentage of thread for various materials as follows: 75-80 per cent—sheet brass, sheet nickel, duralumin, fibre, babbitt, white metal, hard rubber; 70-75 per cent—mild steel, aluminum, cast iron, cast brass; 60-70 per cent—bronze, tool steel, drop forgings, stainless steel, cast steel, nickel, copper; 50-60 per cent—Monel metal, high speed steel. Messrs. Miller and Fullmer suggest 85 to 100 per cent depth of thread for sheet metal and 60 per cent for ductile metals, such as copper and soft brass, which spin up in tapping.

Decimal diameters of the machine screw sizes are as follows:

No.	Major diameter of screw
0	0.060 in.
1	.073 in.
2	.086 in.
3	.099 in.
4	.112 in.
5	.125 in.
6	.138 in.
8	.164 in.
10	.190 in.
12	.216 in.

For screws 1/4 in. and larger the major diameter is equal to the nominal size.

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Drawing in a Single-Action Press—*Discussion*

CHARLES F. KRAUT

In an article under the title given above (*AM*—Vol. 76, page 834), James R. Cornelius tells how he incorporated the double-action principle in a set of tools operating in a single-action press. His idea is original, practicable and of considerable economic value. It is adaptable to and can be used in tools designed for redrawing shells in a single-action press with results comparable to those obtained in a double-action press on many classes of work. Tools for this work are always of interest.

In discussing this article, John J. McHenry (*AM*—Vol. 76, page 1073) says, "I would like to have someone tell me how to determine mathematically at what diameter a shell of stated thickness will redraw to a required reduction without inside support." For this information I can refer him to "Diemaking and Die Design" by F. D. Jones, Industrial Press, New York. On pages 112 to 114 he will find the desired information. Other valuable reference books useful to the up-to-date diemaker are, "Punches, Dies and Gages" by Dowd and Curtis, and "Punches and Dies" by Frank A. Stanley, both of which are published by McGraw-Hill Book Company, Inc., 330 West 42nd St., New York.

The inverted tools illustrated in Fig. 1 are especially adapted for use in a single-action press for the first redrawing operation on shallow shells, and for reducing the diameter of the cups and leveling the flanges of flanged cups. Referring to the illustration, *A* is the bolster; *B* the pressure pins; *C* the forming mandrel; *D* the forming ring, which also acts as a shedder; *F* the retaining and leveling ring; *H* the drawing ring; *K* the flanged cup produced in the first-operation tools (not shown); *L* the reduced cup with the flange leveled; and *M* the vent to prevent the trapping of air or lubricant. The drawing ring is attached to the ram.

In operation, when the ram is at the top of its stroke the forming ring assumes the position in relation to the forming mandrel shown in the upper left-hand corner, because of the pressure transmitted by the pressure pins. The flanged cup is now placed over the forming ring. As the ram descends, the drawing ring contacts with the flange of the cup, which is ironed out between the curved surfaces of the forming ring and the drawing ring, and the cup is drawn between the parallel surfaces of the drawing ring and the forming mandrel. At the end of the stroke the cup is finish formed and the flange is leveled between the surfaces of the retaining and leveling ring and the drawing ring, as shown at *N*. As the ram ascends, the forming ring follows under pressure of the pressure pins, now acting as a shedder, forcing the cup off of the forming mandrel. The cup is then ejected from the drawing ring by the knockout and can be blown off by air or removed hand.

In the tools illustrated in Fig. 2, *A* is the bolster; *B* the pressure pins; *C* the pressure plate; *D* the forming mandrel; *F* the bolt for holding the forming mandrel to the bolster; *H* the compression bolt; *I* the cross-section of a spring, the lower end of which is supported by a pressure plate (not shown) similar to the one at *C*; *K* the forming ring, which also functions as a shedder and supports the limiting pins *L* on an annular flange at the bottom; *M* the retaining ring, which limits the movement of the forming ring and the limiting pins; *N* the drawing ring; *O* the knockout; *P* the drawn shell; and *S* the vents to prevent the trapping of air or lubricant.

How the Tools Work

In operation, when the ram is at the top of its stroke, the forming ring assumes the same position in relation to the forming mandrel as is shown in the tools in Fig. 1. The shell to be redrawn is now placed over the forming ring. As the ram descends, the drawing ring draws the metal over the forming mandrel and contacts with the tops of the limiting pins, which project above the top of the forming ring an amount equal to the wall thickness of the shell, plus 0.002 or 0.003 in., and since the limiting pins are supported by the flange on the forming ring, they oppose the descent of the drawing ring by the pressure transmitted by the pressure pins acting on the forming ring. Thus the ironing surfaces of the drawing ring and the forming ring are held a definite distance apart, regardless of the varying and cumulative pressure transmitted by the pressure pins as the spring is compressed.

From the foregoing it is evident that as the ram descends, the ironing pressure remains uniform throughout the drawing process. The shedding, ejection and removal of the shell is accomplished in the same way as that described for the tools in Fig. 1. The tools are shown as the ram approaches the bottom of its stroke, the drawing of the shell being incomplete, to illustrate the ironing action of the curved surfaces of the drawing and the forming rings.

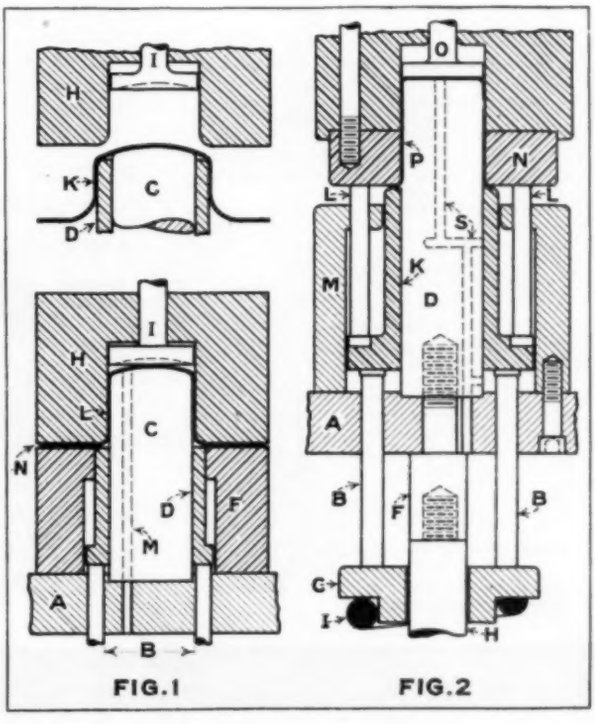
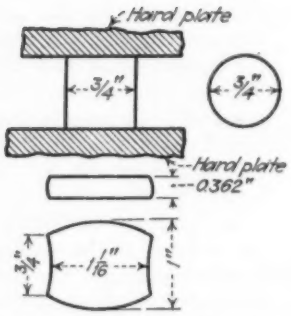


FIG.1 FIG.2

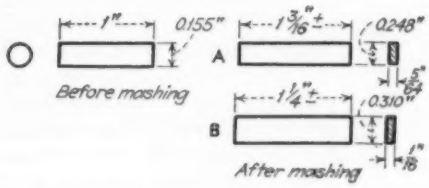
The inverted tools illustrated are especially adapted for use in single-action presses. Here they perform the first redrawing operation on shallow shells, but they also can be employed to reduce the diameter of cups and to flatten the flanges of flanged cups

Press Work Pressures

Series III—*Coining*



Material--Cold rolled steel, 3/4 in. in diameter by 3/4 in. long
Operation--Washed cold to a thickness of 0.362 in.
Pressure--10,000 lb.



Material--Soft steel wire, 1 in. long by 0.155 in. in diameter
Operation--Washed to - A. 5/64 in. thick
B. 1/16 in. thick
Pressure--A. 28,500 lb.
B. 39,500 lb.

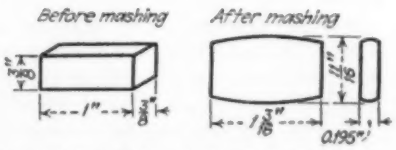
Pressure required for coining depends on area and depth coined, kind of material, length of time that the metal is under pressure and the thickness of the metal. Rules for calculating the pressure required are of little value, thus leaving comparison with a similar job of known pressure as the best method. It is not necessary to have a complete job of similar nature as it is possible to select portions of the work, compare them with similar known jobs of the same size and add the individual pressures.

In designing dies and selecting a press for coining, it should be remembered that the metal is caused to flow under pressure. The shorter the distance of flow the less the pressure will be. A toggle press is the most satisfactory since this type dwells at the bottom of the stroke, thus increasing the time in which the metal can flow. An objection to this type of press has been raised in that dies have been broken on over-size pieces. This objection can be overcome by the use of hydro-pneumatic overload relief cushions.

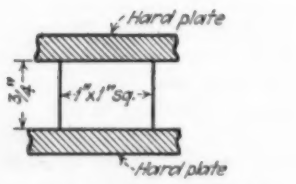
Speed of press operation depends on the area and depth coined. The United States mints get best results at 85 strokes per min. for the larger coins and 110 strokes per min. for the smaller coins. Some manufacturers are running their presses at 200 strokes per min., but at this speed the best work cannot be obtained.

It is now possible to buy an 0.008 carbon steel at the same price as ordinary commercial steel. This steel can be coined cold into shapes that were impossible to coin cold several years ago. In light of this development, some manufacturers are now making use of coining which shows large savings over hot forging, not only in the life of the dies but by the elimination of heating, pickling and machining.

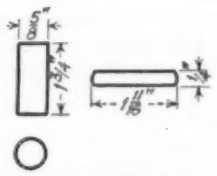
Coining dies can often be relieved, thus allowing a smaller press to be used. Several examples will be given. Often, when breaking-down operations are used for a piece, it is possible to make slight changes in the dies so that a smaller press can be employed. For example, the dies for a certain piece overloaded a 400-ton press. After being redesigned the dies were used satisfactorily in a 250-ton press. Illustrations of die modifications will be given in the various installments on coining.



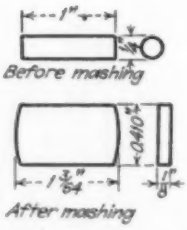
Material--Machine steel, 1 in. long by 3/8 in. thick
Operation--Reduced to 0.195 in. thickness
Pressure--50 tons



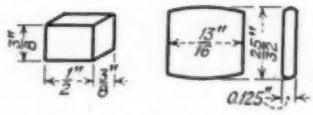
Material--Machine steel, 3/4 in. thick
Operation--Reduced by - A. 1/32 in.
B. 1/16 in.
C. 3/32 in.
D. 1/8 in.
Pressure--A. 63,400 lb.
B. 78,300 lb.
C. 90,000 lb.
D. 101,500 lb.



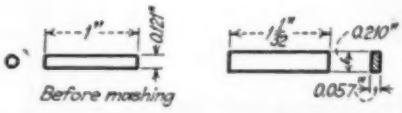
Material--Machine steel, 1-3/4 in. long by 5/8 in. in diameter
Operation--Washed red hot, with one blow of steam hammer. This experiment was made in connection with steel shrapnel cases 3 in. in diameter by 10-1/2 in. long
Pressure--70,000 lb.



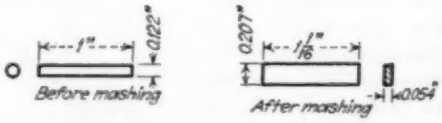
Material--Cold bessemer steel, 1 in. long by 1/4 in. in diameter
Operation--Reduced to 1/8 in. thickness
Pressure--50,000 lb.



Material--Machine steel, 1/2 in. long by 3/8 in. thick
Operation--Reduced to 0.125 in. thickness
Pressure--40 tons



Material--Soft steel wire, 1 in. long by 0.121 in. in diameter
Operation--Washed to 0.057 in. thickness
Pressure--25,000 lb. or 12-1/2 tons per inch of length



Material--Soft steel wire, 1 in. long by 0.122 in. in diameter
Operation--Washed to 0.054 in. thickness
Pressure--26,000 lb.

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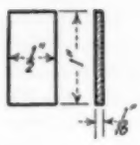
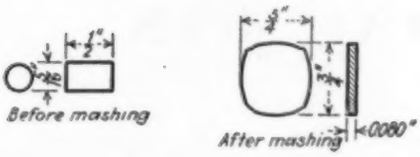
Press Work Pressures

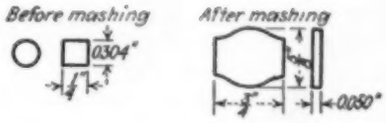
Series III — *Coining*



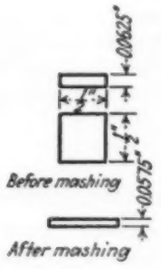
Material--Soft sheet steel, 1/16 in. thick
Operation--Mashed to - A. 0.042 in. thick
B. 0.047 in. thick
C. 0.052 in. thick
Pressure--A. 50 tons
B. 40 tons
C. 30 tons



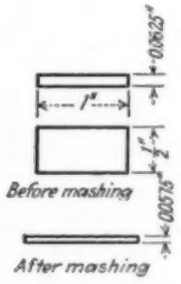
Material--Machine steel, 1/2 in. long
by 5/16 in. in diameter
Operation--Reduce to 0.080 in. thickness
Pressure--Annealed-84,000 lb.
Unannealed-92,000 lb.



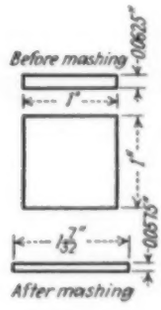
Material--Machine steel, 1/4 in. long
by 0.304 in. in diameter
Operation--Reduced to 0.050 in. thickness
Pressure--82,000 lb., annealed



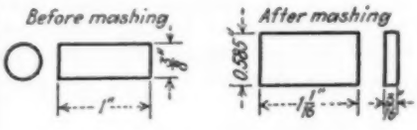
Material--Machine steel, 1/2 in. square
by 0.0625 in. thick
Operation--Reduced to 0.0575 in. thickness
Pressure--19,000 lb.



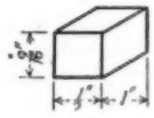
Material--Machine steel, 1 in. long
by 0.0625 in. thick
Operation--Reduced to 0.0575 in. thickness
Pressure--39,000 lb.



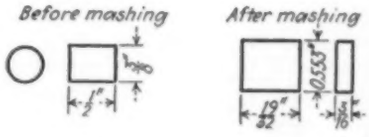
Material--Machine steel, 1 in. square
by 0.0625 in. thick
Operation--Reduced to 0.0575 thickness
Pressure--85,000 lb.



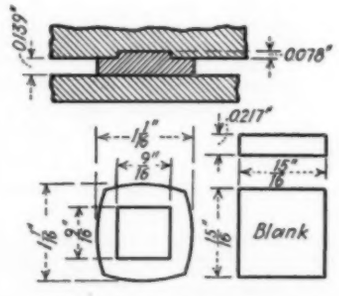
Material--Cold bessemer steel, 1 in. long
by 3/8 in. in diameter
Operation--Reduced to 0.187 in. thickness
Pressure--67,000 lb.



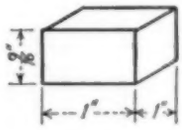
Material--Machine steel, 1 in. long
by 9/16 in. thick, annealed
Operation--Reduced to - A. 17/32 in. thick
B. 1/2 in. thick
C. 15/32 in. thick
D. 7/16 in. thick
Pressure--A. 30,000 lb.
B. 40,000 lb.
C. 45,000 lb.
D. 50,000 lb.



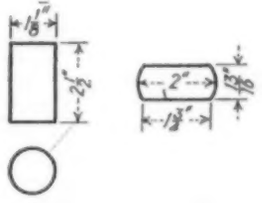
Material--Cold bessemer steel, 1/2 in. long
by 3/8 in. in diameter
Operation--Reduced to 0.187 in. thickness
Pressure--34,000 lb.



Material--Machine steel, 15/16 in.
square by 0.217 in. thick
Operation--Washed to 0.139 in. thickness
Pressure--65,000 lb.



Material--Machine steel, annealed, 1 in.
long by 1 in. wide by 9/16 in. thick
Operation--Reduced to - A. 17/32 in. thick
B. 1/2 in. thick
C. 15/32 in. thick
Pressure--A. 65,000 lb.
B. 85,000 lb.
C. 100,000 lb.



Material--Machine steel, 2-1/2 in. long
by 1-1/8 in. in diameter
Operation--Washed, red hot, with one
blow of steam hammer
Pressure--100,000 lb.

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• IDEAS FROM PRACTICAL MEN

Making Contour Forming Tools Without Calculations
Discussion

CHARLES KUGLER

In his comments on my article under the title given above (*AM*—Vol. 76, page 1138) William S. Rowell says (*AM*—Vol. 77, page 25), "—yet we are told that the cutter is to be used with its *center line* in the horizontal center plane of the work. This would leave the high side of the cutting edge above the center of the work, in which position it would lack clearance and would refuse to cut." I cannot agree with this statement.

Whether or not the high side of the cutting edge would refuse to cut would depend upon the difference in the diameter of the tool and that of the work, as shown in Fig. 1. If the work is large enough in diameter, the high side of the cutting edge will cut, even though the tool is set above the central plane of the work. I believe that the following information will make clear the exact methods of checking the tool and the grinding wheel:

The templets *A* and *B*, Figs. 2 and 3, were set with their major axes in correct relation to the axes of the grinding wheel and the tool to be ground in the following manner: Before the templets were cut off of the bar in the milling machine they were coppered and their major axes were scribed upon them. To check the tool, a line was scribed on the cutting edge in the center of the tool and the line on the templet *B* was made to coincide with that line, as shown in Fig. 2. This brought the major axis of the templet in line with the center of the tool.

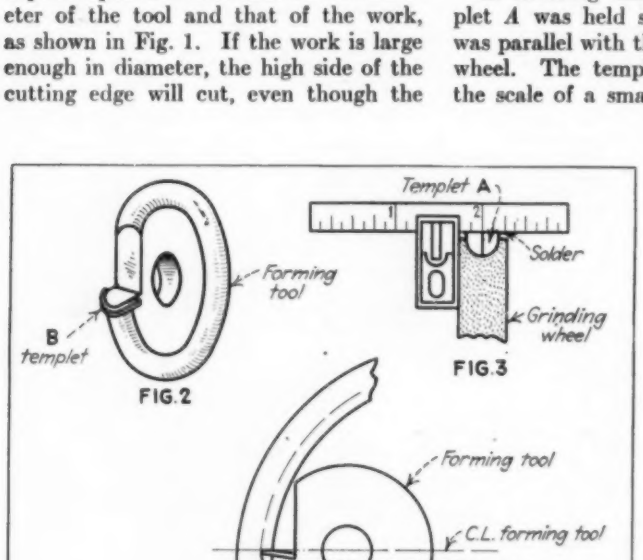
In checking the grinding wheel, templet *A* was held so that its major axis was parallel with the central plane of the wheel. The templet was made fast to the scale of a small combination square with solder and the stock of the square was held against the side of the wheel, the side, of course, being first trued with a diamond. In Fig. 3 is shown just how the templet was held for checking the wheel after the groove had been trued. Before truing the wheel to suit the templet, the groove had been formed by a radius-forming attachment. By the methods described it was not difficult to set the major axes of the templets in the proper positions in relation to the forming tool and the grinding wheel when checking them.

I do not know whether or not the methods used are correct in theory, nor do I claim that they are. I was simply told to grind the tool so it would cut a circular recess of the correct radius in the raceway. After grinding the tool it was tried out by the operator of the turret lathe and the work was passed by the inspector. The operator was told to set the tool as described in my original article, but I do not know whether or not he followed the instructions.

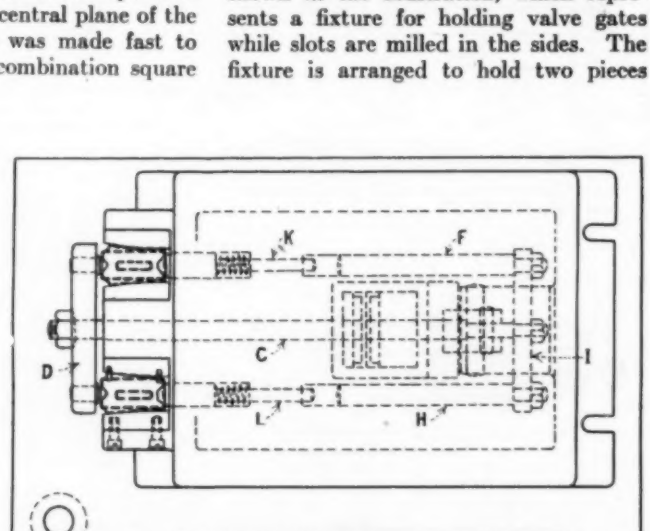
Clamping and Ejecting by Air

FRANK W. CURTIS
Research Engineer,
Kearney & Trecker Corporation

By the use of a double-acting air cylinder in connection with holding fixtures, it is often possible to combine the clamping and ejecting of certain kinds of work. An application of this kind is shown in the illustration, which represents a fixture for holding valve gates while slots are milled in the sides. The fixture is arranged to hold two pieces



Making and using templets to secure correct outlines on form tools. These include templets for the grinding wheel as well as for the tool



Details of a milling fixture that both clamps the work and ejects it after the operation is completed. The air cylinder is built into the fixture

and the machine is equipped with a two-spindle attachment, so that two slots can be milled on opposite sides of each piece.

The air cylinder *A* is built into the fixture and a pin in the piston rod engages a slot in the lower end of the pivoted lever *B*. A slot in the upper end of the lever is engaged by a pin in the drawbar *C*, so that motion is transmitted by the piston to the drawbar, but in opposite directions. When air is admitted to the right-hand end of the cylinder, the piston is moved to the left and the drawbar to the right, carrying with it the clamp *D* and clamping the work.

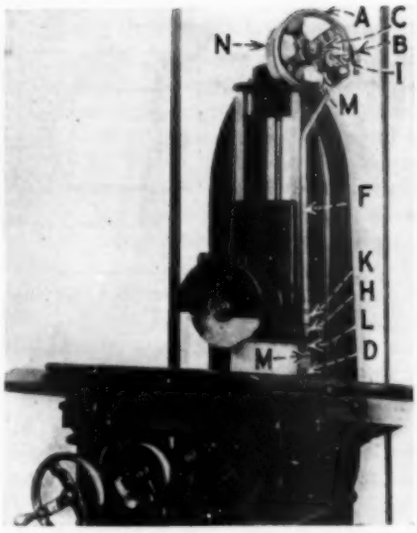
The work is located in taper plates, into which it is forced by the clamp. The knockout rods *F* and *H* are attached to the drawbar by the tieplate *I*. When air is admitted to the left-hand end of the cylinder, the movement of the parts is reversed, the work is unclamped and the knockout rods contact with the spring-actuated ejector pins *K* and *L*, which eject the work. In this particular case, the conical ends of the ejector pins and the conical plugs in the clamp *D*, align the work by entering cored openings in the ends. In loading the work into the fixture, it rests on pins at *M*, supporting it and aligning it approximately until it is held by the clamp.

An Automatic Vertical Feed for a Surface Grinder

H. F. LORING

A vertical feed that was designed for two of our surface grinders is shown in the illustration. These machines were available for grinding small steel parts, the surfaces to be ground being narrow enough to be covered by the width of the wheel, so that the transverse feed need not be used.

The handwheel for the manually-operated vertical feed was replaced by the ratchet wheel *A*. The pawl *B*, carried by the lever *C*, is actuated by a cam attached to the machine table through the follower *D* and the connecting rod *F*. The connecting rod passes through the bearing *H*, which is mounted on the column of the machine and is pivoted to the pawl lever at *I*. The adjustable collar *K* and the spring *L*, on opposite ends of the bearing, limit the depth of cut per stroke of the table. At each end of the connecting rod, the threaded fittings *M* permit adjustment of the working length of the rod and control the maximum travel of the follower. The hub of pawl lifter *N* fits easily on the ratchet-wheel shaft and can be secured in any position by a setscrew.



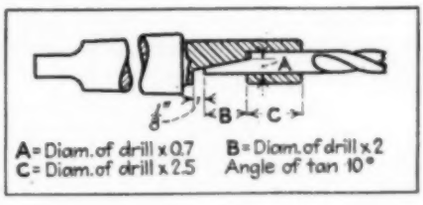
Improvement in the quality of a ground surface was secured by using an automatic vertical feed.

In operation, the grinding wheel is lowered manually until it contacts with the work, and the total depth of cut required is determined by means of a suitable gage. The pawl lifter is then set so that when the total depth of cut has been reached, the pawl will ride upon it instead of on the ratchet wheel, stopping the feed. By eliminating the manual feed, the quality of the grinding was improved because a uniform depth of cut was secured at each stroke of the table. Due to the use of this attachment on two of our grinders, the operator was able to handle two additional grinders with the minimum of lost motion.

Drive for Straight-Shank Drills

MARTIN H. BALL

Where an extension for a straight-shank drill is required for working close to a shoulder, and where there is not room enough for a drill chuck to clear, we have found the method of holding



and driving the drill shown in the illustration to be the most practical.

The 10-deg. angle is easily made on the shank of the drill and in the holder. This angle being the angle of repose, there is no danger of the drill becoming loose in the holder, yet can be easily removed by a small drift.

A Simple Miniature Vise

CHARLES H. WILLEY

Superintendent of Manufacturing, Hoyt Electrical Instrument Works

Instrument makers and toolmakers sometimes have work that is too small or too delicate to be held to advantage in the ordinary bench vise. The need for a small vise to hold such work prompted a toolmaker of my acquaintance to make for himself a small vise like the one illustrated.

The vise is made of pieces cut from ⅛-in. sheet steel and bent into the shape

An easily made small vise for assembly work. Jaws can be made of any shape desired

shown in the sketch, which is clear enough to indicate the details of how it is made. The jaws can be made to any shape that will suit the needs of the work to be done, three examples of various shapes being shown at the right. Since such vises are easy to make, toolmakers can well afford to make several of them, the jaws of each being adaptable to some special work.

A Cure for Drill Breakage
Discussion

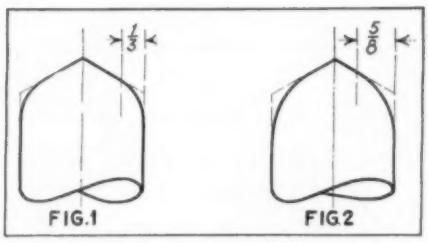
J. A. POTTER

Chief Draftsman, Singer Manufacturing Company, Bridgeport Plant

Referring to the article by John Thomas under the title given above (*AM*—Vol. 77, page 24), possibly the success of the drill ground as Mr. Thomas describes was due to its breaking up of the chip. Also, that the one longer lip radiated the heat faster and would permit the drill to be used at a faster feed, thereby throwing out the chips more readily. It would appear that the increased angle on one of the lips had very little effect in preventing breakage, and that better results would have been obtained if both sides had

been ground at the same angle. Then the cut would have been better balanced and the drill would not have had a tendency to run out.

The article recalls an experiment with drills at a western university about 25 years ago. Twist drills were rounded at the outer ends of their lips so that the straight parts of the lips were tangent to the curves. The drills were then backed off by hand so near as was possible to the conventional 12-deg. relief. The theory was that the longer lips, due



Rounding the corners of a drill in an experiment to prevent breakage

to the curves, would provide greater surfaces for the radiation of heat and, therefore, a faster feed could be used in drilling.

The results were that both the speed and the feed could be increased about 35 per cent; that the drills had no tendency to run out; that they would produce holes in cast iron having a finish equal to that of reaming; that they held their centers better; and that the holes were not oversize. In fact, unless the drills were removed from the holes immediately after drilling, they were likely to stick in the work.

A drill ground so that the lips are rounded for one-third of their length is shown in Fig. 1, while in Fig. 2 is shown a drill so ground that the lips are rounded for about five-eighths of their length. Although the drill in Fig. 2 can be operated much faster than the one in Fig. 1, if the lips are rounded for too much of their length there will be danger of splitting the web when faster feed is used.

Mandrel for Turning and Facing Threaded Work

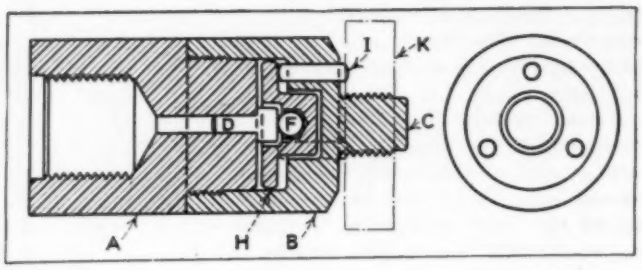
E. W. ERRICK

Tool and Die Designer, Colonial Radio Corporation

It is well known that in turning or facing threaded work that is screwed against the shoulder of a mandrel, the machined surfaces will not be true with the threads. Therefore, in work of this kind it is necessary to provide some sort of compensating or equalizing device.

In the illustration is shown a mandrel for holding threaded work, in which is embodied an equalizing device. It consists of the part *A* to be screwed on the spindle nose of the lathe; the cap *B*, of which the threaded mandrel *C* is an integral part; the hardened plug *D*; the steel ball *F;* the equalizer *H;* and the three pins *I*, which are a sliding fit in the cap. At *K* is the work to be machined.

An equalizing device for holding threaded work so as to insure facing the piece square with the thread. Three pins and a floating plate do the trick



In use, the work is screwed on the threaded mandrel and contacts with the sliding pins. The outer ends of these pins form a 3-point shoulder for the work and the inner ends bear upon the equalizer. The result is that any error in alignment of the threaded part of the work with the threads on the mandrel is communicated by the sliding pins to the equalizer, which rocks on the ball, thus limiting the projection of each pin, so that the outer ends of the pins form a shoulder that is square with the axis of the threaded mandrel, and the work is held true with the threads.

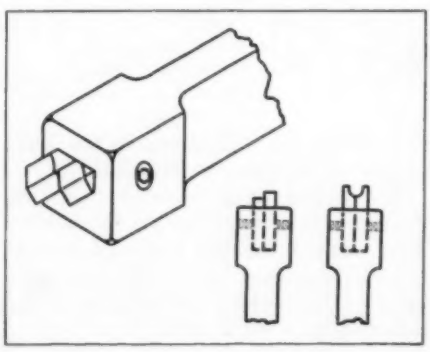
Toolholder for Two Toolbits

PETER L. BUDWITZ

Often a shop has to make a limited quantity of small, shouldered studs. It was for work of this kind that a toolholder like the one illustrated was made.

The hole for the toolbits was broached twice as wide as ordinarily, so as to accommodate two toolbits, side by side. They are held by safety setscrews, one on each side of the holder.

A toolholder of this kind, with its two toolbits, will be found suitable for many purposes, such as making form tools, necking tools, etc. In using the tool for shouldered studs, two diameters are turned simultaneously and the correct length of the larger diameter is obtained by grinding the side of the tool for turning the body.

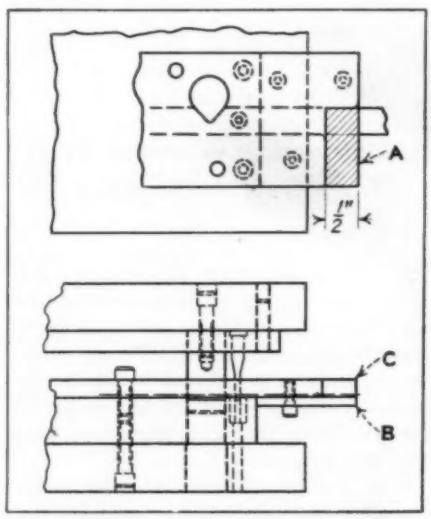


Improvement in Press Tools at Small Additional Cost

FORREST L. JOHNSON

Tool Designer, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, Plant

Low cost tools are not always economical for production. If the management set-up permits, the tool department can often advance a number of profitable suggestions for the improvement of tools at small additional cost.



Slight changes in press tools frequently add much to their efficiency. A simple notch aids in starting a strip

The sketch illustrates a tried-out improvement that eliminates the trouble and delay usually experienced by press operators when starting to feed strip stock to the tools. A ½-in. wide notch is cut in the stripper, so that its rear is fair with the rear liner gage, as at *A*. This will permit the operator to place the strip on the exposed part of the rest plate *B*, immediately gaining the vertical position of the nest. The transverse

position is gained by the strip contacting with the projecting part *C* of the stripper. Thus the operator does not have to lean to one side to look for the opening between the stripper and the die-block.

Should the design of the tools not call for a rest plate, the same design of stripper can be used, permitting the projecting part of the die-block to be used to gain the vertical position of the nest.

Milling Woodruff Keyseats in the Lathe

HOMER COY

When it is required to mill seats for Woodruff keys and no milling machine is available, the work can be done in the lathe by the aid of simple fixtures.

Two pieces of pipe, larger in diameter than the width of the T-slot in the compound rest, and from 4 to 6 in. long, are turned on the outside and the ends are faced. Two holes are drilled and tapped in a piece of flat, cold-rolled steel that is fitted to the T-slot in the compound rest. The pieces of pipe are stood on end on the compound rest and are secured in place by through bolts engaging the piece of flat steel, as shown in Fig. 1. Washers larger in diameter than that of the pipes are used under the bolt heads. The pieces of pipe virtually form a V-block in which the shaft to be keyseated is secured by clamps.

If the keyseat is to be milled several inches from the end of the shaft, pieces of round, cold-rolled steel can be substituted for the pieces of pipe. In this case, the steel pieces are attached to a plate mounted on top of the compound rest and extending over the side, as shown in Fig. 2, this plate is clamped to the compound rest by screws engaging in tapped holes in a plate in the T-slot. Since the pieces of cold-rolled steel are mounted on the offset part of the plate, the end of the shaft clamped to them can project downward between the shears of the lathe as far as is necessary, the floor being the only limit.

Another job that can be done in the fixture shown in Fig. 1 is milling a square on the end of a shaft, using an end mill, as shown in Fig. 3. Milling the first side with the compound rest set at 45 deg., the rest is rotated 90 deg. counter-clockwise, and the second side is milled. Without changing the setting of the rest, the shaft is unclamped and is set with the first side against the end mill. By indexing and resetting the other sides can be readily milled.

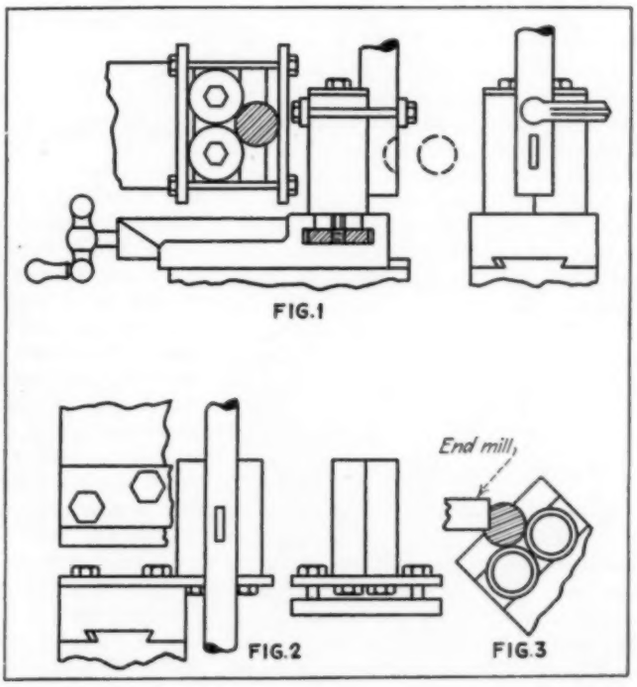


FIG. 1

FIG. 2

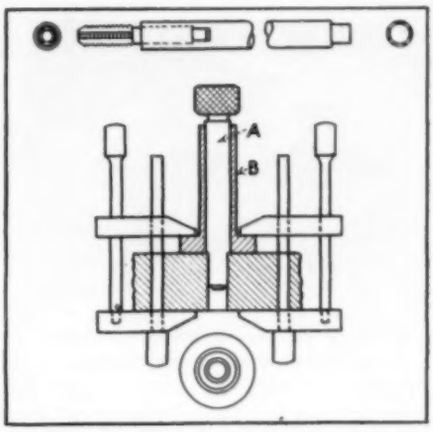
FIG. 3

Here is a job which the small shop does in a lathe when there is no milling machine available. The same idea can be readily applied to other jobs than milling keyseats, with slight modifications

A Tap-Guiding Fixture

JOHN W. GERDEL

The idea for the fixture here described was prompted by the necessity of having to drill and tap a large number of holes in the base plates for dies in die-casting machine. As the bodies of the screws had to pass through about five inches of cast iron in fairly snug-fitting holes, it was necessary to have the tap enter the plates square with the surface. The plates were of machine steel, about 1½ in. thick, 12 in. wide and 15 in. long.



Holes can be tapped square by using this form of guide

Neither a drill press nor a lathe of the type proper for such a job were available, so I made the fixture illustrated. The shouldered guide *A* was bored and reamed to 0.625 in., the bottom being faced at the same setting. The plug *B* is a snug fit in the guide, the lower end being turned to fit the tap-drill hole. An extension holder, as shown in the upper part of the illustration, was made for the ½-in. tap, and fitted snugly in the guide.

In use, with the plug in the guide, the guide was placed on the plate and the small end of the plug was entered into the hole to be tapped, locating the guide, which was then clamped to the plate with two parallel clamps. Withdrawing the plug, the tap in its holder was inserted in the guide. By the use of this fixture the holes were tapped accurately square and the screws were easily pulled to their shoulders.

A Holder for the Ink Bottle

FRANK W. BENTLEY, JR.

A great many home made devices have been put together to hold the bottle of drawing ink conveniently on or around the sloping drawing board. Many ink-bottle troubles, however, do not occur as the result of the bottle being upset, but from the ink spilling from the quill filler, or from the nibs of the pen as it is being filled.

To prevent the drop of ink from getting on the drawing, get a common, five-cent, soft-rubber soap tray and cut off the ribs from the inside of the bottom, so that the ink bottle can set level at one end of the tray. Do the filling of the pen over the empty end of the tray, and a drop of ink as big as your hand cannot reach the drawing or tracing.

Keeping the ink bottle in a rubber tray keeps drawings clean

The soft rubber of the tray prevents it from slipping or sliding on the sloping board and the edges prevent it from upsetting. The tray can be set as close to the working surface of the drawing as desirable. The illustration shows the scheme.

Press Tools for Forming Pipe Clips

E. F. EBERHARD

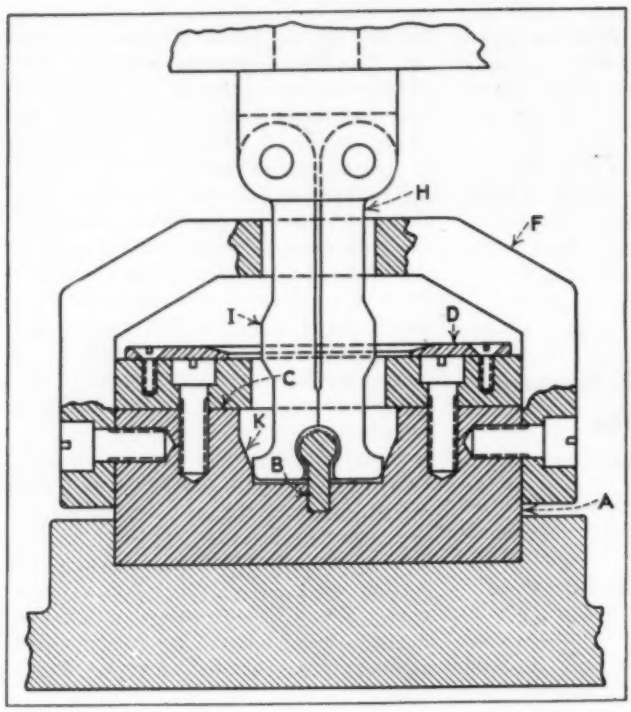
The tools illustrated are for forming pipe clips, such as the one indicated by heavy dotted lines in the tools. The clips are blanked in ordinary blanking tools and are then formed in the tools illustrated at one stroke of the press. All the bends are made successively, so that there is no drawing or stretching action, resulting in smooth and unbroken surfaces in the vicinity of the bends.

The tools consist of the die-block *A*; the hardened insert *B*; the forming plate *C*, having a rectangular hole to permit the passage of the punches; the nest plate *D*; the yoke *F*, having a rectangular hole for guiding the punches; and the punches *H*, which are hinged or pivoted to the punch-holder.

When the ram is in its uppermost position, the punches are guided by the rectangular hole in the yoke, in which they are centralized by the projections at *I* on their sides.

In operation, a blank is located on top of the plate *C* by the nest *D*. When the ram descends and the lower ends of the punches pass the upper edges of the hole in the forming plate, they form the two lower bends on the clip. As the ram continues its descent, the punches carry the partly formed clip through the forming plate and into contact with the serrated top of the insert *B*. At this point, the projections *I* on the punches have passed through the guide hole in the yoke and the punches are swung away from each other in the act of bending the clip over the curved surface of the insert. As the ram approaches the end of its stroke, the heels on the punches contact with the inclined surfaces *K* and the punches are forced toward each other, completing the bending.

As the ram ascends, the punches are swung apart and clear the formed clip, which is then ejected by a blast of compressed air controlled by a valve that is operated by a lug on the ram.



Two pivoted punches are guided by projections and inclined surfaces. These punches, in conjunction with the serrated top on the stationary former, automatically close the clip, and then swing clear as the ram ascends

SEEN AND HEARD

JOHN R. GODFREY

Long Nuts

Advocates of the "jam" or "flow" method of obtaining thread fits will be interested in the practice of one of the automobile builders. Spring clip bolts and other bolts under the car have nuts at least three times the normal thickness. This is obviously not for strength, as the normal nut with half a thread, will break the bolt in most cases. The thread engagement in the long nut gives enough error in lead, angle and pitch diameter to flow the thread into the nut, and stay tight, without cotter pins.

Noise, Vibration and Cork

It has long been known that vibration is the cause of noise where machine operation is concerned. Naturally, then, the first thing to do is to eliminate vibration just as far as possible, and the next is to absorb or isolate what is left. With the second factor in mind, engineers have lately been making use of cork. Cork is a natural shock absorber because it is compressible, and because it does not lose its "life" under compression. The tiny air cells in the structure of cork are hermetically sealed, which keeps it from becoming flat and lifeless. Special cork boards are used as machine foundations. Just the proper area of the cork board must be used under a machine of given weight, for the cork must be compressed to just the right degree for best results. In cases where additional weight is needed it is sometimes necessary to pour a concrete foundation on top of the cork before setting the machine.

Light Metal for Higher Speeds

As speeds of machines increase we find more and more aluminum and other light metals used to lighten high speed parts. This seems to be true whether the parts rotate or reciprocate, especially if they must start and stop suddenly. An early use was in the belt pulleys of planers to reduce power loss and save belt wear and squeal. Incidentally, they found that it took more power to reverse the heavy cast-iron pulleys than it did the loaded table. Then a high speed sewing machine designer solved his problem by using a light metal needle arm, and a couple of machine tool builders found that light metals on reciprocating parts are a great help when it comes to boosting speeds. What about using a light metal ram on a shaper or slotter?

SHOP EQUIPMENT NEWS

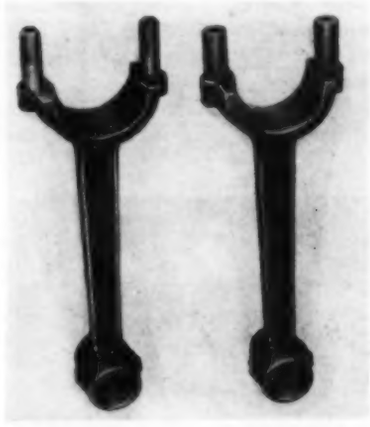
Greenlee Vertical Indexing Machine with Oscillating Cam Feed

A vertical indexing machine of the oscillating cam-feed type is now available from Greenlee Bros. & Co., Rockford, Ill., for multiple-operation work on large-production parts. The machine can be arranged for such operations as drilling, boring, reaming, counterboring, spot facing, milling, threading and tapping. As illustrated, the machine has seven operating positions and one loading position, and is used for rough and finish facing the cap seats and crowning, turning and threading the studs of a connecting rod.

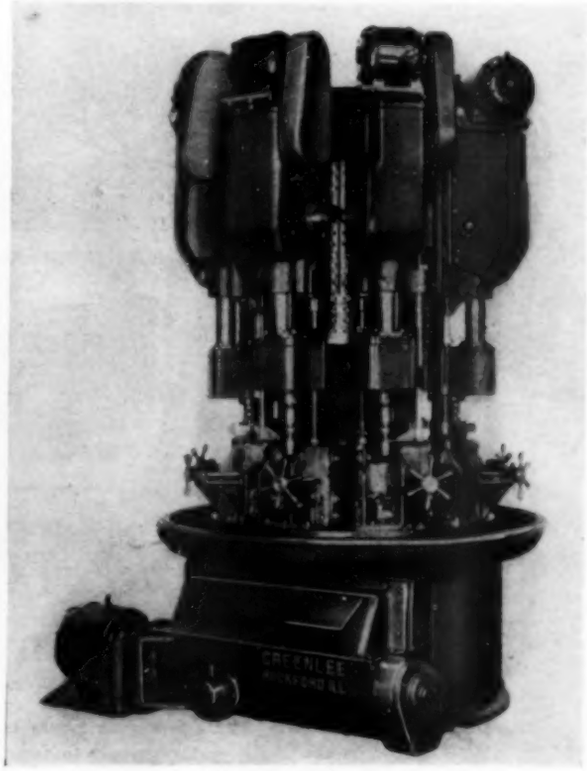
The machine consists of a base supporting a table which indexes automatically, and a circular column upon which is mounted a group of quill-feed drive units for attaching single- or multiple-spindle drilling, boring and milling heads. Table indexing and feed drive members are located in the base. As standard, 3, 4, 6 or 8 table positions are provided, one being used for loading. Changing one gear is all that is necessary to change the number of indexes per revolution, and when required provision can be made for other than standard positions.

On the standard machine the column is drilled, tapped and provided with keyways for attaching the drive units in any or all table operating positions. Each drive unit has individual motor drive to the head drive spindle through silent chain and sprockets, and the feed is by segment cams mounted on an oscillating drum carried on the column. The heads can be designed to accommodate a large number of spindles.

In addition to the provision for changing the position of the drive units on the column, they can be placed at various heights to suit the height of work and the work-holding fixtures. Each drive unit quill also has independent adjustment for height, and a hand turnover is provided for setting the tools and checking the head and quill adjustments.



A connecting rod machined on the Greenlee vertical indexing machine. Cap seats have been faced and bolt studs have been turned, crowned and threaded



Seven operating and one loading positions are provided in this Greenlee Vertical Indexing Machine with oscillating cam feed. This type of machine can be arranged for such operations as drilling, boring, reaming, counterboring, spot facing, milling, threading and tapping on large-production parts

Bunting Machined and Centered Phosphor-Bronze Bars

To minimize machining for the user of bushings and bearings, the Bunting Brass & Bronze Co., Toledo, Ohio, is now making a line of machined and centered phosphor-bronze bars. Outside diameters are concentric with inside diameters. The usual centering of the bar stock is eliminated. Bars are 13 in. long instead of the conventional 12 in., furnished with sufficient stock on the outside diameter to allow a finished bushing to be machined to the size labelled on the bar. Cored bars are rough cast on the inside diameter to the size stamped on the bar and the user should allow approximately $\frac{1}{8}$ in. finishing stock on this dimension. The ends of cored and solid bars are machined. The 13-in. bars will allow the machinist

to obtain multiples of standard bushing lengths such as 1½, 2, 3, 4 and 6 in., which cannot be done in a 12-in. bar due to length loss in the cutting-off operation.

U. S. "Syncrogear" Motor

Furnished for any output speed from 2 to 10,000 r.p.m., "Syncrogear" motors, built by the U. S. Electrical Mfg. Co., Los Angeles, Calif., comprise a self-contained, single-base, geared transmission, foundationed on a heavy gear pedestal base. This construction minimizes cantilever stresses from overhanging gears by a short train structure. All torsional stresses are converged toward a center where the pyramidal gear pedestal base supports the entire unit. Permanent alignment of intermeshing gears is assured because cast-iron parts are normalized.

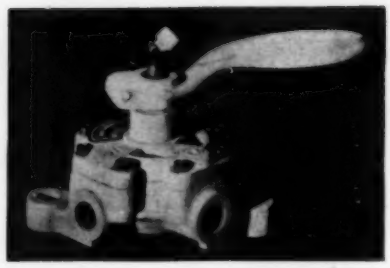
Helical gears and pinions throughout the "Syncrogear" provide for continuous

rolling contact and smoothness of power flow. The high-speed gears of the transmission are not completely submerged in the oil reservoir to do away with heat and foaming caused by high-speed churning of the lubricant. Accessibility permits removal for inspection of either the gears or the electric rotor unit without disturbing other members. The motor employed is the standard high-speed type of 3,600 r.p.m. or lower to take advantage of lower price and better power factor and efficiency. Anti-friction bearings are standard. Supports for the main gear bearings are cast integrally with the gear case. Gear ratios may be changed subsequently at the place of installation.

Hanna "Unitite" Valve

In the "Unitite" valve developed by the Hanna Engineering Works, 1765 Elston Ave., Wicker Park Station, Chicago, Ill., the valve disk seats on the valve bonnet and both may be reground without removing the valve body from the pipe line or disturbing pipe connections or valve mountings. Renewals can be made quickly by simply removing the socket-head capscrews. Between reversals, the disks rotate on two eccentric points while in contact with the seats. Circular lines of contact or scoring do not develop, and both the disk and seat wear uniformly.

The Unitite valve is of the packless type, and both disk and stem are quickly lubricated by an oil well in the stem. The valve is universal in its application and may be used as straight-way, 3-way or 4-way types. Two inlet ports are provided to facilitate piping. Full direct port opening is secured with a 40-deg. movement of the operating handle, and a reversal with an 80-deg. movement. The operating handle may



Quick renewal of the Hanna "Unitite" Valve can be effected without disturbing the valve body

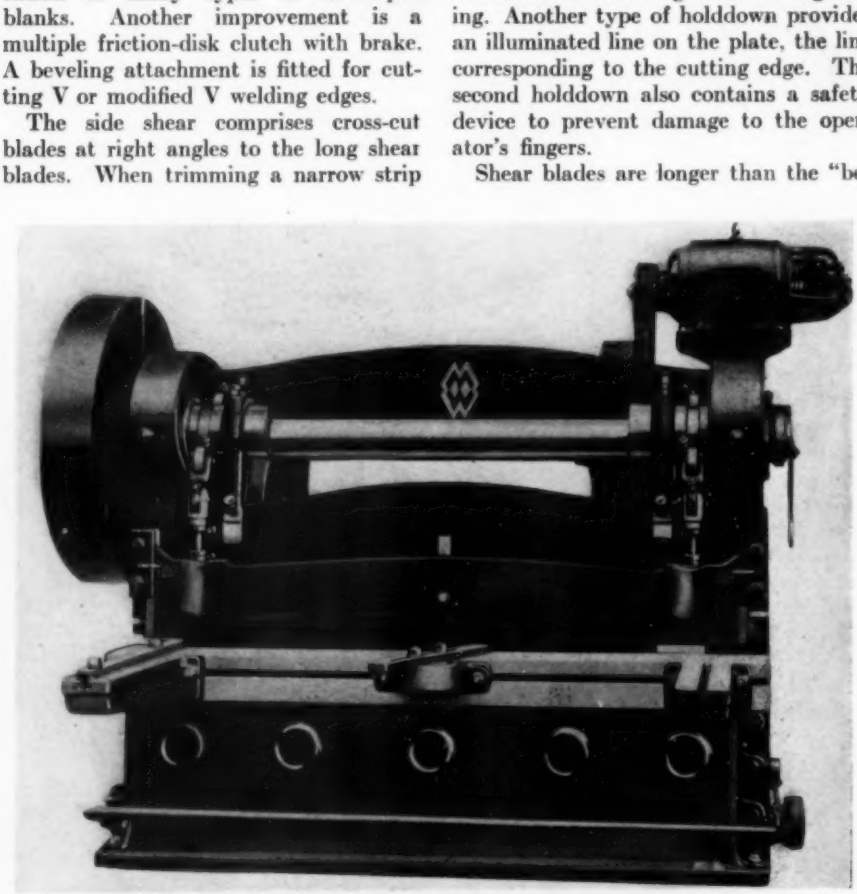
be adjusted to the most advantageous operating position. The valve is suitable for air, oil or water at pressures up to 250 lb. per sq.in.

Schatz Improved Squaring Shear

Improvements have been made recently in the line of squaring shears built by the Schatz Mfg. Co., Poughkeepsie, N. Y. A "compensating" drive permits instantaneous stopping of the slide at any point of the stroke and its return without completing the cycle. Thus, a plate can be cut into as far as desired, which is of value in the preparation of many types of developed blanks. Another improvement is a multiple friction-disk clutch with brake. A beveling attachment is fitted for cutting V or modified V welding edges.

The side shear comprises cross-cut blades at right angles to the long shear blades. When trimming a narrow strip from a long plate, the side shear snips off the trimmings at the end of each stroke and facilitates further feeding. The upper blade is attached to the slide while the lower blade is held in a swing-away holder. The automatic plate holddown is self regulating to the thickness of plate. This holddown can be swung up out of the way to provide free access when removing blades for grinding. Another type of holddown provides an illuminated line on the plate, the line corresponding to the cutting edge. The second holddown also contains a safety device to prevent damage to the operator's fingers.

Shear blades are longer than the "be-



The slide of the improved Schatz Squaring Shear can be stopped at any point in the cycle and returned to top position

tween housings" dimension. For example, on a 10-ft. machine (between housings), the actual length of the blade is 140 in. The lower blade is fixed to an I-shaped, tool-steel blade with vertical and horizontal adjustments. A device prevents accidental tripping.

Heavy shears can be provided without a flywheel and employ direct motor drive to effect savings in power consumption. Machines with the friction-disk clutch are available in 80 sizes, while smaller shears with the steel-bolt clutch may be had in 26 sizes.

South Bend 9-In. "Toolmaker" Lathe

A simplified bench lathe of 9-in. swing, known as the "Toolmaker" lathe, has been developed by the South Bend Lathe Works, South Bend, Ind. This lathe is of the back-geared, screw-cutting type, and is mounted on pedestal style legs. It has a triple V-way bed of steel and iron mixture and uses a ¼-hp. motor to power a horizontal drive. The drive may be mounted on the bench or affixed to the wall. For those preferring it, the lathe will be available with a countershaft drive.

According to the manufacturer, this lathe will handle any machining or grinding operation usually assigned to a lathe of this size, whether in the laboratory, machine shop or repair shop. It will cut all standard screw threads from 4 to 40 per in., will handle straight and taper turning, boring and reaming, and will do drilling, cutting-off, buffing, grinding and polishing operations. Attachments can be fitted for milling, keyway cutting and other special work. In addition to all metals, the lathe will turn, thread or bore fibre, wood, hard rubber, celluloid and other compositions.

Mechanical features of the lathe include a six-speed backgeared headstock, hollow spindle of alloy steel, felt-wick lubricated bearings, extra long carriage bearings, carriage lock for facing, graduated compound rest with micrometer collars. Construction throughout is of iron and steel. No die-castings are used. Bulletin 9-G describes the lathe more completely.

Garlock Lubricating Pastes for Packings

Proper and regular lubrication of packings in service is essential to successful operation. To provide packing users with correct lubricants for packings, the Garlock Packing Co., Palmyra, N. Y., has developed lubricating paste compound No. 2 for steam and water packings and compound No. 3 for packings working against gasoline and oils. Pastes are packaged in standard 12 oz., 24 oz. and 5-lb. cans.

Laboratory, machine shop or repair shop work can be done on this simplified South Bend 9-in. "Toolmaker" Lathe

Boston Types LD and HK Speed Reducers

Speed reducers built of standard parts have been added to the line manufactured by the Boston Gear Works Inc., North Quincy, Mass. The compound worm gear Type LD, Fig. 1, is adapted for slow-moving driven members such as small stoker drives and conveyor drives. It is available in ratios from 37.5 to 1740 to 1. Gears are of cast bronze and worms are hardened steel with threads ground. Timken taper roller bearings are employed.

The compound helical Type HK, Fig. 2, is also assembled from standard parts, and can be supplied in ratios from 9.79 to 84 to 1. This speed reducer is also equipped with Timken tapered roller bearings and has splash lubrication.

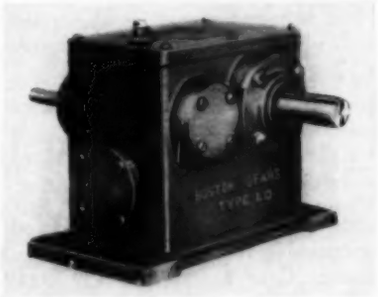


Fig. 1—Boston Type LD Speed Reducer for slow-speed drives

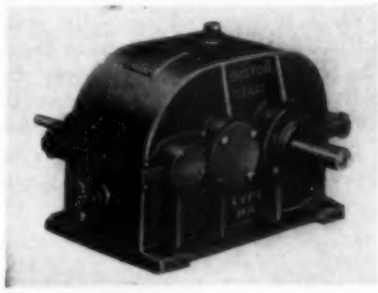
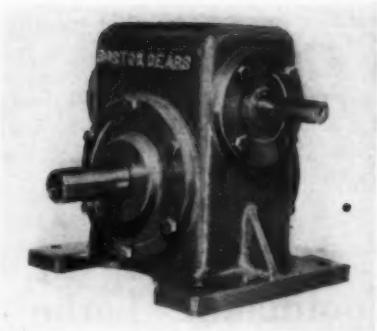


Fig. 2—Boston Type HK Speed Reducer of compound helical construction

"American Swiss" Needle Files with Knurled Handle

The American Swiss File & Tool Co., 410-416 Trumbull St., Elizabeth, N. J., is now manufacturing a line of needle files with a knurled handle or tang in place of the old style smooth round handle or tang. The knurling prevents slippage and assures a firm grip without cramping the fingers of the user. These needle files are made in all the regular shapes and sizes at no advance in price over the former style.

Boston Worm Gear Speed Reducers



The worm gear speed reducer illustrated is the smallest of a line now being manufactured by the Boston Gear Works Inc., North Quincy, Mass. Reduction ratios range from 10 to 1 up to 100 to 1, and horsepower ratings range from ⅛ hp. to 3 hp. This speed reducer has been designed so that the worm is above the gear to bring the heavily loaded shaft nearer to the foundation bolts and give greater strength. Shaft diameters are oversize, making outboard bearings unnecessary except in cases where special length of shaft is desirable.

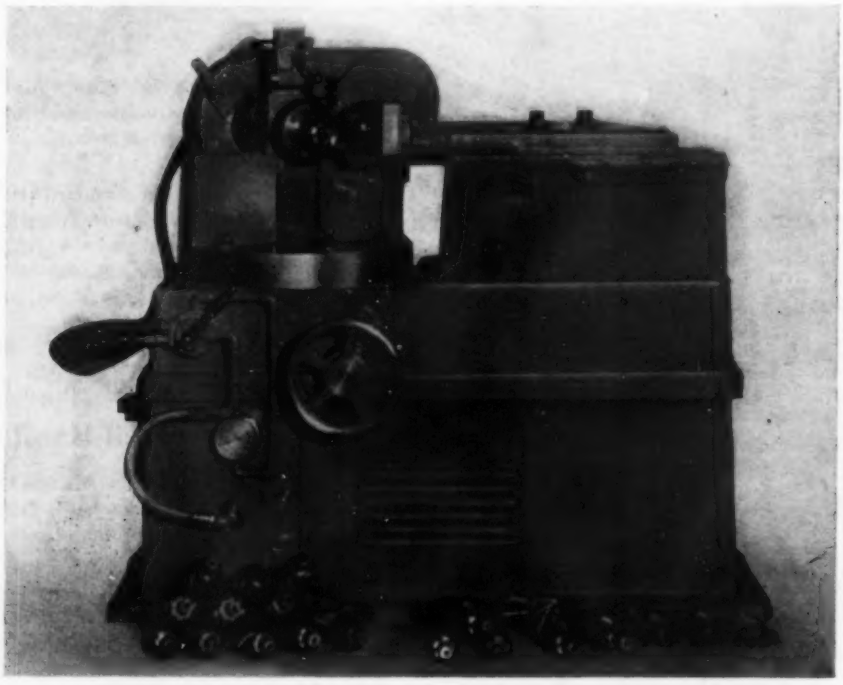
The high-speed shaft is above the oil level. The speed reducer is leakproof when the oil is kept at the proper level. Timken tapered roller bearings are employed on both the high and low speed shafts. These speed reducers can be supplied in the motorized form with a.c. motors of ⅛ to 3 hp.

Bilgram Gear Chamfering Machine

Spiral bevel gears are chamfered on the machine recently announced by the Bilgram Gear & Machine Co., 1217-35 Spring Garden St., Philadelphia, Pa. Every tooth of the spiral bevel gear has at each end on one side a featheredge, which if not removed before hardening, is likely to crack off when the gear is put in operation and thus cause damage. The Bilgram machine removes these featheredges at the rate of more than 100 gears per hour, wheels or pinions.

The machine is of the box type, and the toolhead on the front of the ram is equipped with two tools. Thus, it is possible to chamfer both ends of one tooth with every stroke. The chuck for holding the gears is operated either by compressed air or hydraulically. The headstock is adjustable to any angle from zero to 90 deg. Gears up to 18 in. in diameter and pinions with as few as five teeth can be chamfered.

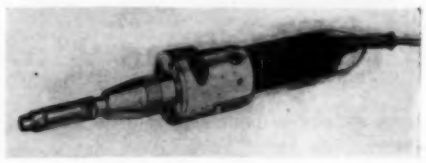
The machine operates at a speed of 100 to 160 strokes per min. Power is furnished by a 2-hp. motor. Approximate time for setting up for the various size gears is 10 min. Weight, 2,500 lb.



Gears up to 18 in. in diameter and pinions with as few as five teeth are chamfered on this Bilgram machine

Bosch Portable Electric Screwdriver and Nut Setter

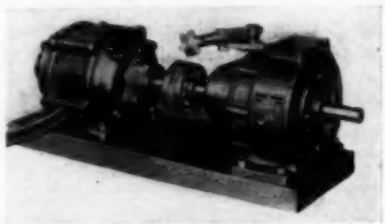
The United American Bosch Corp., Springfield, Mass., has developed a portable automatic electric screwdriver and nut setter that can be used on machine and wood screws or nuts in quantities.



The outside diameter is only 2 in. and the weight is only 3¾ lb. The tool has an automatic pressure clutch, adjusted through a scale for varying the driving force. A fan-cooled universal motor is employed. A special stationary centering sleeve with self-centering bit prevents damage to screw heads. Insulation used in the tool is Resistex.

Johnson Variable Speed Reducer

A self-contained infinitely variable speed reducer has been placed on the market by The Smith Power Transmission Co., Penton Bldg., Cleveland, Ohio.

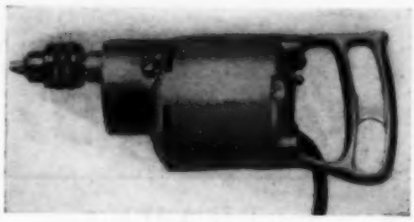


Johnson Variable Speed Reducer connected to a 1-hp., 1,200 r.p.m. motor

This "Johnson" reducer runs in a bath of oil, is compact, and will give infinite speed control from zero to any desired speed, using a control that is visible and quickly manipulated. It is said that the unit is stopped instantly. It is noiseless in operation. Capacities from 1 hp. up are built.

"Signal" Portable Electric Drill

A portable electric drill for light duty has been placed on the market by the Signal Electric Mfg. Co., Menominee, Mich. Weighing only 6 lb., this drill contains a universal motor for a.c. or



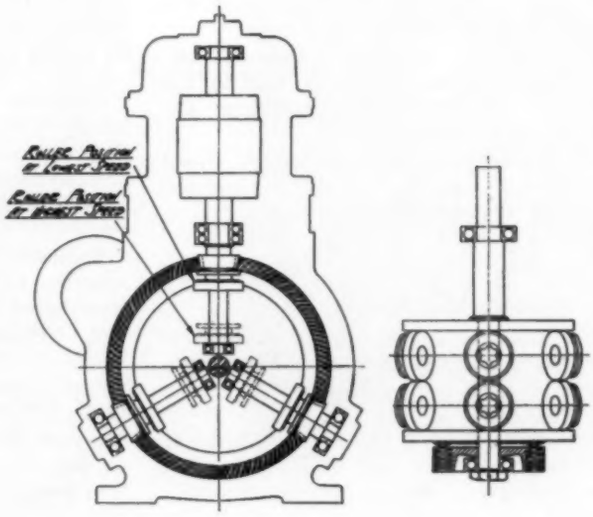
"Signal" ¼-In. Light-Duty Portable Drill

d.c. use, 110 volts, 25 to 60 cycles. No load speed is 1,700 r.p.m. The drill is 11¼ in. long, from the handle to the chuck, and the diameter is 4 in. Drill body and handle are cast aluminum. Special alloy heat-treated gears operate in a grease-tight chamber. Capacity of the three-jaw chuck is ¼ in.

Stanley Speed Variator

A variable speed power unit of the disk and roller traction type has been placed on the market by the Merritt Engineering & Sales Co., Inc., Lockport, N. Y. This "Stanley" speed variator has a speed range of 3 to 1 with an infinite number of speeds between these limits. A built-in motor forms part of the unit known as Type S. Types SR and SSR contain, in addition to the motor, speed reduction gearing adapting the output shaft to the same range in lower speeds. The variator is offered in units of 2 to 20 hp. Special units capable of a maximum ratio of 9 to 1 with constant horsepower output are also available.

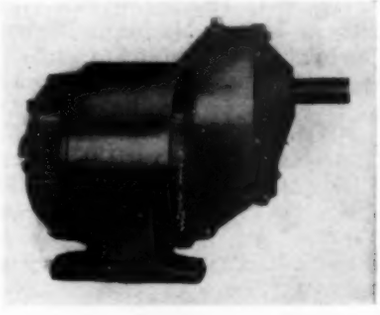
The characteristic of this unit is the constant horsepower output at all speeds. Three pairs of driving rollers arranged radially about the output power shaft are positively driven from the built-in driving motor. A pair of disks, secured to the output shaft, receive their motion through frictional contact with the driving rollers. Simultaneous radial adjustment of the roller pairs effects the variable speeds of rotation of the output shaft. By a spring arrangement, the driven disks are given a pre-determined amount of pre-load upon the driving rollers, which are in turn designed for conservative loading. The possibility of slippage between the rollers and disks is governed by the contact pressures provided by the fixed spring adjustment. The resistance to slippage in all cases exceeds the overload capacity of the motor.



Three sets of driving rollers are arranged radially about the output shaft. A spring urges the disks and rollers together

Westinghouse Type S Gearmotors

Where mechanical means are required for reducing the normally high motor speed to satisfactory operating speeds, the line of Type S Westinghouse Gearmotors provides a simple and compact unit. A Gearmotor is scarcely longer overall than a motor. It is designed for drives from ½ to 1 hp. and for speeds from 1550 to 232 r.p.m. It can be connected direct to driven equipment or by cog belts, chains or flat belts. Fourteen reductions of ratios from 1.12:1 to 5.1 are available for each motor speed and horsepower. The drive is made by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



Bosch Portable High-Speed Electric Die Grinder

For finishing metal patterns and dies, the United American Bosch Corp., Springfield, Mass., has developed a high-speed electric die grinder which is compact and has a spindle speed of 50,000

r.p.m. This speed is procured without vibration, enabling the tool to do classes of work of unusual character and also permitting the use of small wheels of 3/64 to 5/8 in. in diameter. It is said that the tool will grind accurately very small radii and that ordinarily inaccessible places may be ground. A pistol grip is furnished and the housing is of Resistex insulation.

Ex-Cell-O Motor-Driven Spindle for "Abrasive" No. 3 Surface Grinder

Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has announced an inbuilt, balanced, motor-driven grinding spindle designed for the "Abrasive" No. 3 surface grinder. The rotor of the electric motor is mounted directly on the spindle shaft, and the motor field is mounted on the opposite end of the spindle from the grinding wheel. Rating of the motor is 1 hp., and it can be furnished for 220-, 440- or 550-volts, three-phase, 50- or 60-cycles. The grinding spindle portion of this unit has the same standard construction as all "Ex-Cell-O" spindles. Precision ball bearings are employed throughout, except on the outer end of the motor where an oilless bearing is used. Belts and pulleys for driving the grinding spindle are eliminated to reduce vibration and to enable the operater to take heavier cuts at each pass of the wheel.

• PATENTS •

MARCH 7, 1933

Metal-Working Machinery

Grinding Machine. Joseph H. Hoern, Saginaw, Mich., assigned to Wilcox-Rich Corp. Patent 1,900,112.

Sheet Metal Drawing Press. Otto Kuhner, Goppingen, Germany. Patent 1,900,291.

Chucking Machine. Arthur J. Lewis, Stratford, Conn., assigned to the Baird Machine Co. Patent 1,900,387.

Tools and Attachments

Tailstock for Lathes and the Like. Arthur N. Emmons, Syracuse, N. Y., assigned to the Porter-Cable Machine Co. Patent 1,900,233.

Lathe Dead Center Actuating Device. Adolph Storm and Thor Thorsen, Minneapolis, Minn., assigned to Storm Manufacturing Co., Inc. Patent 1,900,261.

MARCH 14, 1933

Metal-Working Machinery

Centerless Grinding or Polishing Machine. Rufus W. Fuller, Deerfield, Mass., assigned to Production Machine Co. Patent 1,900,984.

Machine for Cutting Metal Bars and the Like. Harry F. Vickers, Detroit, Mich. Patent 1,901,067.

Multiple Spindle Metal Working Machine. Olof Enoch Trobeck, Berlin, Germany, assigned to The National Acme Co. Patent 1,901,206.

Electric Welding Machine. Merritt R. Wells, Cleveland Heights, Ohio, assigned to The McKay Co. Patent 1,901,211.

Electric Welding Machine. Merritt R. Wells, Cleveland Heights, Ohio, assigned to The McKay Co. Patent 1,901,212.

Grinding Machine. Waldo J. Guild, Worcester, Mass., assigned to the Heald Machine Co. Patent 1,901,236.

Cutting Mechanism. (Torch) Adolf Messer, Frankfort-on-the-Main, Germany. Patent 1,901,254.

Milling Machine. Sol Einstein and Lester F. Nenninger, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,901,290.

Milling Machine. Max De Haas and Bernard Sassen, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,901,295.

Machine Tool. Walter D. Archea, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,901,489.

Milling Machine. Walter D. Archea, Cincinnati, Ohio, assigned to the Cincinnati, Ohio, assigned to the Acme Ma- 1,901,490.

Machine Tool Construction. Charles Meier and Theodore A. Wettig, Cincinnati, Ohio, assigned to the Acme Machine Tool Co. Patent 1,901,522.

Tools and Attachments

Chuck. Thomas J. Hudson, Cleveland, Ohio, assigned to the Warner & Swasey Co. Patent 1,900,934.

Circular Chaser Grinding Gauge. William J. Hogg, Cleveland, Ohio, assigned to the National Acme Co. Patent 1,901,242.

Chuck for Nut Tapping Machines. Sherman Barber, Maywood, Ill. Patent 1,901,579.

Processes

Method of Cutting Metal by Means of Gases. James L. Anderson, Tenafly, N. J., assigned to Air Reduction Co. Patent 1,901,428.

MARCH 21, 1933

Metal-Working Machinery

Hob Grinding Machine. Carl G. Olson, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,901,926.

Variable Radius Attachment for Milling, Planing, Grinding, or Scraping Machines. Victor Lee Emerson, Philadelphia, Pa. Patent 1,901,952.

Machine Tool. Robert N. Brown, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,902,012.

Drilling Machine. Ernst A. Beste, Kohler, Wis. Patent 1,902,055.

Screw Making Machine. Reuben S. Crosby, Hartford, and Charles W. Sponsel, Wethersfield, Conn., assigned to The Asa S. Cook Co. Patent 1,902,117.

Machine Tool. Alexander Oberhoffken, Rockford, Ill., assigned to The Ingersoll Milling Machine Co. Patent 1,902,179.

Machine for Sharpening Screwing Taps and the Like. Herbert William Hunt and Percy Hunt, Manchester, England. Patent 1,902,240.

Indexing Mechanism for Machine Tools. George E. Randles, Cleveland, Ohio, assigned to The Foote-Burt Co. Patent 1,902,520.

Grinding Machine. Frederick G. Hughes, Bristol, Conn., assigned to The New Departure Manufacturing Co. Patent 1,902,555.

Automatic Lathe for High Speed Work. André Bechler, Moutier, Switzerland. Patent 1,902,754.

MARCH 28, 1933

Metal-Working Machinery

Machine Tool. Edward J. Kearney and Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,903,114.

Cam Grinding Apparatus. Charles G. Trefethen, Worcester, Mass., assigned to Norton Co. Patent 1,903,149.

Processes

Method of Cutting Gears. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works. Patent 1,903,043.

• TRADE PUBLICATIONS •

BAKELITE LAMINATED. Bakelite Corp., 247 Park Ave., New York, N. Y., has issued a publication "Bakelite Laminated" describing the properties and uses of laminated materials incorporating Bakelite resin. Directions for working the material are included. Color charts show the wide range of colors and decorative effects available in the products of two manufacturers. Applications of the material are illustrated throughout the pamphlet.

BEARING ALLOYS. Research Paper No. 512, issued by the U. S. Department of Commerce, Bureau of Standards, is entitled "White-Metal Bearing Alloys: Mechanical Properties at Different Temperatures and Service Tests." It is for sale by the Superintendent of Documents, Washington, D. C., for $0.05.

BERYLLIUM COPPER. The Riverside Metal Co., Riverside, Burlington County, N. J., has issued a circular on the properties and processing of beryllium copper on which it has recently gone into production on sheet, strip wire and rod forms. A table of suggested applications is a valuable feature.

EFFECT OF CUTTING CONDITIONS ON HARDNESS. Research Paper No. 516, issued by the U. S. Department of Commerce, Bureau of Standards, is entitled "Effect of Lathe Cutting Conditions on the Hardness of Carbon and Alloy Steels". It is for sale by the Superintendent of Documents, Washington, D. C., for $0.05.

GRINDERS. Catalog A-32, issued by the Landis Tool Works, Waynesboro, Pa., describes the Type C 6- and 10-in. plain hydraulic grinders, the latter being a new machine.

STRESSES IN SCREW THREADS. Bulletin No. 245 issued by the Engineering Experiment Station, University of Illinois, Urbana, Ill., is entitled "Determination of Stress Concentration in Screw Threads by the Photo-Elastic Method." Results show a stress in the American Standard thread form about 40 per cent greater than that of the Whitworth thread.